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Essays on Business Relations and Corporate Finance

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Essays on Business Relations and Corporate Finance

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Dissertation

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Doctor of Philosophy

The University of Texas at Austin

August 2013

To Quique

Acknowledgments

This dissertation could not have been written without the invaluable guidance and support of my supervisor Aydoğan Altı. His commitment to perfection in all aspects of our profession has been the inspiration to try harder, and it will be the most important lesson that I will take with me. It is also a privilege to have had the opportunity to present my work to Sheridan Titman, whose comments and intuition are the most valuable teachings any Ph.D. student can get. Special thanks goes to my graduate advisor and my committee member Andres Almazan for patiently mentoring me over the course of my graduate studies. I cannot forget my committee members Jonathan Cohn and Jason Abrevaya, whose comments and contributions were indispensable for the completion of this dissertation. Also, I am indebted to Clemens Sialm and Jennifer Huang for the privilege of working with them as a co-author, and for all the support that they have given me throughout my Ph.D. years. Finally, I would like to thank Laura Starks for the opportunities and doors that she has opened for me that expanded my vision of the profession.

Essays on Business Relations and Corporate Finance

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The University of Texas at Austin, 2013

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This dissertation studies the impact of business relations on firms' financing decisions. The goal is to understand the determinants of business relations and how they interact with firms' capital structure. In the first chapter, I present a model which studies the role of customer risk in suppliers' financing choice. The base model predicts that when faced with a high-risk customer, suppliers with significant continuation values prefer equity over debt. The extended model allows for analyzing the supplier's decision to concentrate on a single major customer or diversify into multiple customers. The model shows that by decreasing the risk of premature liquidation, diversification allows for the supplier to take advantage of the bargaining benefits of debt.

The second chapter empirically investigates the impact of customer risk on suppliers' capital structure. Consistent with the model presented in the first chapter, both cross-sectional and time-series regression results show that customer risk has a negative impact on suppliers' debt financing. Customer risk is an important determinant of suppliers' method of financing as well. During the first two years of the relationship, suppliers with high-risk customers are more likely to raise equity. Comparing the impact of customer risk on different supplier groups shows that firms that operate in concentrated industries and younger firms are more sensitive to changes in customer risk. In further analyses I find that the risk is transferred from customers to suppliers: There is a lead-lag relationship between customer and supplier credit rating changes. Also, suppliers experience an increase in volatility of their stock returns after they start a new relationship with a risky customer. Results from further analyses are suggestive of customer risk affecting capital structure through its impact on supplier risk.

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1 A Simple Model of Customer Risk and Supplier Financing

1.1 Introduction

In this essay, I study the impact of a major customer's debt on the supplier's capital structure and production decisions. I present a base model, which shows that when the supplier is dependent on a single customer, high customer debt is associated with low supplier debt, assuming that the supplier's continuation value is sufficiently high. This result follows from the fact that when continuation value is high, the cost of early liquidation dominates the bargaining benefits of debt, and as a result equity becomes preferable. An extended version of the model allows for simultaneously studying the supplier's financing choice and its decision to work with a single customer or multiple customers. There is a range of moderate values of continuation in which the supplier prefers equity over debt when diversification is not possible, but the supplier finds it optimal to issue debt when it is allowed to diversify into multiple customers. In other words, diversification decreases the risk of premature liquidation, and allows for the supplier to take advantage of the bargaining benefits of debt.

Studies show that firms can change their capital structure strategically in order to manage their relationships with competitors, customers and suppliers. A great deal of theoretical analysis has sought to understand the bargaining benefits of debt financing within the context of labor relations or suppliers of other critical inputs. The general finding of the literature is that by decreasing the amount of funds

available, debt financing leaves less payoff to workers in a bargaining framework.

Several studies have investigated the role of capital structure in firms' relationships with their major input suppliers. For instance, Bronars and Deere (1991) show that by decreasing the amount of funds available for a potential union, higher debt helps to protect shareholders' wealth against unionized workers. Dasgupta and Sengupta (1993) argue that high debt might distort the effort away from the first-best level, and as a result, the optimal choice of debt balances the bargaining advantage of debt against the cost of moral hazard. They show that debt financing may then alleviate the effort problem by encouraging more investment. Similarly, Matsa (2010) provides a model which delivers the result that increased debt helps to shield liquidity from workers, especially when profitability is expected to be high. Subramaniam (1996) examines the underinvestment problem that is observed when a customer firm makes an investment upfront, and the supplier can expropriate the profits by threatening to delay or stop production. Subramaniam demonstrates that this underinvestment problem can be mitigated if the firm is allowed to issue debt and retire equity subsequent to the investment decision. Hennessy and Livdan (2009) show that debt increases the agency costs for firms relying upon (implicit) relational contracts for the provision of incentives, and that the trade off between bargaining benefits of debt and the resulting inefficiency determines the optimal capital structure.

Customer-supplier relationships are different than firms' relationships with their workers. While workers can increase their bargaining power by increasing unionization, suppliers of critical inputs and buyers of primary outputs can use their own

capital structure in order to increase their bargaining power against the firm. For capital structure to affect the division of economic rents between two firms, it is essential that either the product is specific to the relationship and/or the amount of output is large. In both cases, the relationship becomes critical, and the termination of it can be very costly for both parties. If firms are equally important for each other, product specificity does not necessarily affect the relative bargaining powers. This makes capital structure an important tool that firms can use in order to increase their bargaining power against other firms that they are in relationship with.

The model is similar to those in Bronars and Deere (1991), Matsa (2010) and Subramaniam (1996) with two major differences. First, the model studies the relationship with a major customer rather than workers, and confirms that debt financing positively affects the supplier's bargaining payoff. Second and related to this, it emphasizes the importance of the customer's capital structure on the financing decision, and delivers the result that when customer debt is high, the optimal capital structure is not necessarily high debt.

While a number of theoretical studies have examined the impact of capital structure on firms' relationship with their major input suppliers, there is not much discussion on how the capital structures of two firms might interact during the bargaining. Besides the importance of major customers on suppliers' capital structure decisions, another motivation for studying the topic from the supplier's perspective is the availability of data. In accordance with the Statement of Financial Accounting Standards (SFAS) no. 14 and 131, public firms are required by the SEC to report the sales to

and identity of any customer that comprises more than 10% of a firm's consolidated sales revenues. This requirement makes it possible to detect suppliers with major customers, but not necessarily the customers who might be dependent on them. Banerjee, Dasgupta and Kim (2008) investigate the impact of business relations on dependent suppliers' capital structure. They argue that dependent suppliers might hold less debt in order to protect themselves against the loss of principal customers. To my knowledge, this is the first model that formalizes the idea that the supplier's dependence and capital structure decisions are interrelated.

In the existing literature, the input suppliers are generally passive (Bronars and Deere (1991), Matsa (2010)), or they decide on effort (Dasgupta and Sengupta (1993)), investment (Subramaniam (1996)) or quality (Hennessy and Livdan (2009)). The contribution of this model is that it studies the capital structure decision of input suppliers given the firm's own capital structure. It emphasizes the trade off between the cost of financial distress and bargaining benefits of debt. More importantly, it shows that this trade off significantly depends on the amount of customer debt.

This chapter proceeds as follows. Section 1.2 describes the base model, and Section 1.3 solves the base model. Then, Section 1.4 extends the base mode for multiple customers. Section 1.5 discusses testable implications. Finally, 1.6 summarizes findings and concludes.

1.2 The Model

1.2.1 Framework

The base model consists of two periods and two players: a supplier and a customer. The supplier produces one unit of intermediate good, and the customer uses this good in order to produce the final good. At time 0, the customer and the supplier decide whether the supplier will produce for the customer or not. At time 1, if the customer and the supplier agree on the price, the customer purchases the intermediate good from the supplier and sells it in the market. The amount of output is normalized to one unit. There is uncertainty regarding the market price of the final good, which will be resolved after the supplier produces the intermediate good but before it is delivered to the customer. After the uncertainty is resolved, the customer and the supplier bargain on the price at which the customer will buy the intermediate good from the supplier. Interest rates are assumed to be zero. The shareholders of the customer and the supplier are risk neutral, and both firms maximize their shareholders' value. Finally, at time 2 the supplier receives its continuation value unless it is liquidated. Figure 1.1 shows the timeline of the events.

1.2.2 The Supplier

The unit cost of the intermediate good to the supplier, which the supplier pays at time 0, is denoted as I. The supplier does not have any internal resources so that it either issues debt (due at time 1) or raises equity in order to finance I. The supplier raises only the amount necessary to complete the production, and it can not hold cash reserves. If the customer and the supplier agree on the price, they

equally share the surplus from the trade.[1] If trade does not happen, the supplier sells its output in the market at a price of L. I assume $L < I$ such that the market value of the intermediate good is less than its cost. Note that the more specific the product is, the higher the wedge between I and L is. The expected value of the supplier's continuation is given by Y, that is measured at time 2.

1.2.3 The Customer

At time 0, the customer has debt in place with a face value of D_c due at time 1. The supplier takes this face value as given.[2] At time 1, with probability θ, demand for the customer's final product is high, and price per unit is P_H. With probability $1 - \theta$, demand for the final product is low, and price per unit is P_L with $P_H > P_L$. After demand uncertainty is resolved, there are two options for the customer: First, the customer can produce a less sophisticated product without the need for the supplier's output and sell it in the market at a price of $\overline{P}$. If the customer chooses this option, trade does not happen. Production without the supplier's input is costless, but it does not yield a high payoff such that $P_L > \overline{P}$. For simplicity, assume that the customer's outside option is zero ($\overline{P} = 0$). Second, the customer can invest C in order to convert the supplier's intermediate good into final product, and the trade happens. The customer does not have cash and has to

[1] In Section 1.5, I relax this assumption, and examine the impact of bargaining power on the outcome.

[2] Throughout the model, I assume that the supplier takes customer debt as given, and that the customer's financing decision is independent of its relationship with the supplier. Although, it is a restrictive assumption, it is not unrealistic given the nature of the dataset being used. As a result of the data generating process, the customers in Customer Segment Data are large compared to their suppliers (and an average firm in the Compustat universe). Cohen and Frazzini (2008) report that the median customer is in the 98th percentile of CRSP firms whereas median supplier is in 48th percentile.

raise financing if it decides to invest into the supplier's product. For both states I assume that trade generates a surplus

$$P_i > C + I + L \quad \text{for} \quad i \in \{L, H\} \tag{1.1}$$

This assumption is important because it ensures that when there is no customer debt, trade happens in all states regardless of how the supplier finances its production. Also, it ensures that the project has positive NPV such that $\theta P_H + (1-\theta)P_L > I + C$.

1.3 The Base Model with Single Customer

1.3.1 The Base Case: Low Customer Debt

The aim of this model is to study the supplier's choice of financing given different levels of customer debt. For this purpose, it is useful to start with the low customer debt where the face value of customer debt satisfies:

$$0 \leq D_c \leq P_L - C - I \tag{1.2}$$

Note that this case includes zero customer debt as well. The condition in (1.1) ensures that trade generates surplus in both states of the world. At time 0, before the state is realized, the supplier makes its financing decision. At time 1, after the state is realized the supplier and the customer bargain on the payoffs. I assume that the customer and the supplier equally share the surplus from the trade, and they agree to trade as long as their payoffs from bargaining with trade is greater

than the value of their outside options.[3] Let S_{i_j} be the trade surplus where $i \in \{L, H\}$ denotes low- and high-demand states, and $j \in \{E, D\}$ denotes the supplier's financing choice. First, I solve the bargaining problem given the supplier's choice of financing, and then I find the method of financing that maximizes the expected value of the supplier's shareholders.

Suppose that in the first period, the supplier raises equity in the first period. The customer and the supplier equally share the following surplus from the trade:

$$S_{E_i} = P_i - C - D_c - L \tag{1.3}$$

provided that

$$S_{E_i} > 0, \quad \forall i \in \{L, H\} \tag{1.4}$$

The constraint in (1.4) ensures that trade yields payoffs above the value of their outside options for the customer and the supplier. Note that with equity financing, since there is no risk of liquidation, the supplier can sell the output in the market at L if trade does not happen. Here, I do not allow for the customer to strategically extract part of the supplier's continuation value in the bargaining process. Since my focus is on the impact of customer distress, I rule out the impact of customer debt on the supplier's continuation payoffs. For this, I assume that the continuation value is the present value of expected future payoffs, and it cannot be pledged for current debt. The supplier's payoff from trade is given by:

$$\frac{S_{E_i}}{2} + L = \frac{P_i - C - D_c + L}{2} \tag{1.5}$$

[3]Here, the underlying assumption is that if the customer or the supplier defaults, the other party cannot bargain with the creditors of the firm.

which satisfies

$$S_{E_i} = P_i - C - D_c - L > 0 \tag{1.6}$$

Note that the inequality in (1.1) is sufficient for this constraint to be satisfied. With equity financing, the value of the supplier's shareholders is given by:

$$V_E = \theta \left[\frac{P_H - C - D_c + L}{2} \right] + (1 - \theta) \left[\frac{P_L - C - D_c + L}{2} \right] + Y - I \tag{1.7}$$

Similarly, with debt financing, the surplus from trade is given by:

$$S_{D_i} = P_i - C - D_c - D_s \tag{1.8}$$

provided that

$$S_{D_i} > 0, \quad \forall i \in \{L, H\} \tag{1.9}$$

With debt financing if trade does not happen, the supplier's outside option is zero, which follows from $I > L$. The transfer from the customer to the supplier under debt financing is given by:

$$\frac{S_{D_i}}{2} + D_s = \frac{P_i - C - D_c + D_s}{2} \tag{1.10}$$

provided that

$$S_{D_i} = P_i - C - D_c - D_s > 0, \quad \forall i \in \{L, H\} \tag{1.11}$$

Trade happens in both states, and the face value of debt is equal to the cost of production ($D_s = I$). Therefore, the condition in Eq. (1.11) coincides with the assumption in (1.2). The value of the supplier's shareholders under debt financing

is given by:

$$V_D = \theta \left[\frac{P_H - C - D_c - I}{2} \right] + (1 - \theta) \left[\frac{P_L - C - D_c - I}{2} \right] + Y \tag{1.12}$$

Proposition 1 *Suppose that customer debt D_c satisfies $0 \leq D_c \leq P_L - C - I$, then for any continuation value Y, the supplier prefers debt financing over equity.*

This result supports the conclusions of previous studies that debt financing increases the payoff from bargaining. By issuing debt, the supplier can incorporate the face value of its debt into the bargaining outcome.

Corollary 1 $\frac{\partial(V_D - V_E)}{\partial I} > 0$ *and* $\frac{\partial(V_D - V_E)}{\partial L} < 0$.

As I increases, the bargaining benefit of debt increases, and the difference between the supplier's value with debt and equity becomes larger. With equity financing, the initial investment of I is a sunk cost, and it is not included in the bargaining payoffs. On the other hand, with debt financing, part of this cost is shared with the customer as D_s is included in the bargaining payoffs. The reverse holds for L: The difference between the value with debt and equity becomes smaller as L increases. This follows from the fact that with debt financing, the supplier's outside option is zero, whereas with equity the supplier can sell the output at L. Note that C does not affect the supplier's financing choice.

1.3.2 Medium Customer Debt

The interesting case happens when trade generates a surplus but because of high customer debt trade does not happen. If customer debt lies within the interval

$$P_L - C - I < D_c < P_L - C - L \tag{1.13}$$

then with equity financing the customer and the supplier still trade in the low-demand state, but not with debt financing. If customer debt is high such that $D_c \geq P_L - C - L$, then in low-demand state trade does not happen regardless of the method of financing, which will be analyzed in the next subsection.

Under equity financing, the transfers from customer to the supplier are given in (1.5)

$$\frac{S_{E_i}}{2} + L = \frac{P_i - C - D_c + L}{2}$$

Note that if (1.13) holds, then $S_{E_i} > 0$. With debt financing, the surplus from trade is given by:

$$S_{D_i} = P_i - C - D_c - D_s \tag{1.14}$$

provided that

$$S_{D_i} > 0, \quad \forall i \in \{L, H\} \tag{1.15}$$

If trade does not happen, the supplier's outside option is zero. The transfer from the customer to the supplier under debt financing is given by:

$$\frac{S_{D_i}}{2} + D_s = \frac{P_i - C - D_c + D_s}{2} \tag{1.16}$$

Given the condition in (1.13) holds, then (1.15) is only satisfied for the high-demand state, and trade does not happen in the low-demand state. One can solve for the face value of debt as $D_s = \frac{I-(1-\theta)L}{\theta}$. The value of the supplier's equityholders with equity and debt are given by the following:

$$V_E = \theta \left[\frac{P_H - C + L - D_c}{2} \right] + (1-\theta) \left[\frac{P_L - C + L - D_c}{2} \right] + Y - I \qquad (1.17)$$

$$V_D = \theta \left[\frac{P_H - C - D_s - D_c}{2} \right] + \theta Y \qquad (1.18)$$

Comparing the shareholders' value with debt and equity financing shows that there is a threshold value of continuation above which the supplier prefers equity over debt.

Proposition 2 *Suppose that customer debt satisfies* $P_L - C - I < D_c < P_L - C - L$, *then for continuation values* $Y < (>) \frac{I - \theta L - (1-\theta)(P_L - C - D_c)}{2(1-\theta)} = Y_M$, *the supplier prefers debt (equity) financing.*

In the low-demand state debt decreases the bargaining payoffs, and trade does not happen. On the other hand, with equity financing the customer does not share the cost of production with the supplier but the supplier enjoys the continuation value in both states. For high levels of customer debt, the supplier trades off the bargaining advantage of debt with the cost of early liquidation. Thus, for high continuation values, the supplier prefers equity over debt.

Corollary 2 $\frac{\partial Y_M}{\partial I} > 0$, $\frac{\partial Y_M}{\partial L} < 0$, *and* $\frac{\partial Y_M}{\partial (1-\theta)} < 0$.

For higher values of I, the bargaining benefit of debt is higher, and the threshold value of continuation above which equity is preferred over debt increases. The reverse holds for L such that as L increases, the difference between the value with equity and debt becomes smaller. Also, a higher probability of liquidation increases the

likelihood of equity being preferred, which results from higher expected loss from early liquidation.

Corollary 3 $\frac{\partial Y_M}{\partial C} > 0$, $\frac{\partial Y_M}{\partial D_c} > 0$ *and* $\frac{\partial Y_M}{\partial P_L} < 0$.

While higher C or D_c increases the threshold, the high customer debt case becomes more likely when L, C or D_c is high. Finally, higher P_L increases the payoff under equity financing as well as the difference between the shareholders' value with equity and debt.

1.3.3 High Customer Debt

In the previous case, equity financing has an advantage over debt financing: In the low-demand state trade happens only if the supplier chooses to finance its production with equity. With debt financing, trade surplus is reduced by both the supplier's and the customer's face value of debt. As a result, it becomes more likely that the bargaining payoffs will not be enough to generate surplus for the customer's and the supplier's shareholders, and trade does not happen in the low demand state.

In the high customer debt case, assume that the following assumption holds

$$D_c \geq P_L - C - L \tag{1.19}$$

Customer debt is high such that trade never happens when the low-demand state is realized. As before, under equity the optimal bargaining outcome yields the same trade surplus given in (1.3)

$$S_{E_i} = P_i - C - D_c - L$$

Similarly, with debt financing, the surplus is as follows:

$$S_{D_i} = P_i - C - D_c - D_s$$

Note that if trade does not happen, the supplier's outside option is zero. With high customer debt given in (1.19), trade does not happen in the low-demand state regardless of the state of the world. Here, I implicitly assume that price in high-demand state is large enough for trade surplus to be positive.[4]

The face value of debt satisfies $D_s = \frac{I-(1-\theta)L}{\theta}$, and the supplier's expected payoff under equity financing is given by:

$$V_E = \theta \left[\frac{P_H - C + L - D_c}{2} \right] + (1-\theta)L + Y - I \tag{1.20}$$

Similarly, with debt financing

$$V_D = \theta \left[\frac{P_H - C - D_s - D_c}{2} \right] + \theta Y \tag{1.21}$$

Proposition 3 *Suppose that customer debt satisfies $D_c \geq P_L - C - L$, then for continuation values $Y < (>) \frac{I-L}{2(1-\theta)} = Y_H$, the supplier prefers debt (equity).*

Comparing both payoffs under debt and equity shows that for high values of continuation, the supplier prefers equity over debt. For low continuation values, equity is less attractive because I is a sunk cost for the supplier. While trade never happens in the low-demand state, the supplier can still collect the continuation value if it chooses equity financing.

[4] $P_H > C + D_c + \frac{I-(1-\theta)L}{\theta}$ is the sufficient condition for this.

Corollary 4 $\frac{\partial Y_H}{\partial I} > 0$, $\frac{\partial Y_H}{\partial L} < 0$, *and* $\frac{\partial Y_H}{\partial(1-\theta)} < 0$.

As it is the case for the medium customer debt case, a higher I requires a higher threshold value of continuation for equity to be preferred over debt. With debt financing, liquidation value affects the supplier's payoff only through the face value of debt. A higher liquidation value is associated with a lower face value, which in turn increases bargaining benefits of debt in the high-demand state. On the other hand, a higher liquidation value increases the supplier's bargaining payoff under equity financing in both high- and low-demand states. If the supplier can easily sell its product to another customer, the cost of no trade decreases, which increases the value under equity financing in the low-demand state. Finally, a higher probability of low-demand increases the risk of liquidation, which in turn decreases Y_H, and makes equity financing more likely. Note that the difference between the value of the supplier's equityholders with debt and equity is independent of C, D_c and P_L.

1.3.4 Comparing Medium and High Customer Debt Cases

Proposition 2 and Proposition 3 show that in both regions, a high continuation value is associated with equity financing rather than debt. However, the threshold values of continuation are different for those two regions.

Lemma 1 *If $D_c < P_L - C - L$ holds, then $Y_M < Y_H$ such that the threshold value of continuation with medium customer debt is lower than that with high customer debt.*

The major advantage of equity financing comes from the fact that it never leads to liquidation, which exists for both medium and high customer debt cases. With

high levels of customer debt, in the low-demand state, trade does not happen regardless of the method of financing. However, when D_c is not too high (i.e. in the medium customer debt case) trade still happens in the low-demand state with equity financing. This makes equity even more preferable compared to debt, yielding a positive payoff in the low-demand state. Because of this advantage, even for lower values of continuation that satisfy $Y_M < Y < Y_H$, equity is preferred over debt when customer debt is not high. In the context of a continuum of possible debt-to-equity ratios, the supplier issues more equity given medium levels of customer debt compared to high customer debt case. Table 1.1 provides a comparison of the supplier's payoffs for different cases.

1.4 Extension of The Base Model: Multiple Customers

The base model studies the financing decision of a supplier that takes demand as given. In this section, I relax this assumption by allowing for the supplier to choose between working with two identical customers or being dependent on a single major customer.

When a customer approaches to a firm to become its preferred supplier, the supplier has the option to concentrate on the customer or stay as one of many firms that the customer works with if the terms of the contract are not attractive. However, if the supplier makes investments specific to the relationship upfront that are expected pay off in later years of the relationship, then it might not be easy for the supplier to adjust its sales to the major customer. Furthermore, in such cases, the customers might obtain concessions in the form of low price or trade credit with

extended payment periods.[5] Although, the supplier has the option to halt delivery if the customer fails to make payment to the supplier, the supplier still has the risk of not being able to replace the customer immediately.

The supplier's decision to have a concentrated or diversified customer portfolio requires a cost-benefit analysis. In general, the cost of concentration is the product uniqueness and resulting loss in the specific investments upon the early termination of the relationship. On the other hand, dependence might provide higher profits in the form of higher prices or lower transaction costs. The benefit of diversification is the reduced risk of financial distress, which results from the cross-pledging of revenues.

In this extended version of the model, I simultaneously investigate the supplier's capital structure decision and concentration choice. As before, assume that the supplier has the capacity to produce one unit of intermediate good. The supplier can sell this output to one customer, called the "major customer", or to two identical "small customers". Assume that each of these small customers is half of the size of the major customer. The demand for the customers' products are independent from each other. For the cases with single and multiple customers to be comparable, I also assume that the face value of each small customer's debt is half of the major customer's debt.

Suppose that customer debt satisfy the condition $D_c \geq P_L - C - L$ given in high customer debt case. First, consider the trade with the major customer. The value of the concentrated supplier's shareholders under equity and debt financing

[5]See Cunat (2007), Petersen and Rajan (1997), Evans (1998) and Wilner (2000).

are given in (1.20) and (1.21):

$$V_E^c = \theta \left[\frac{P_H - C + L - D_c}{2} \right] + (1-\theta)L + Y - I$$

$$V_D^c = \theta \left[\frac{P_H - C - D_s - D_c}{2} \right] + \theta Y$$

where $D_s = \frac{I-(1-\theta)L}{\theta}$.

If the supplier chooses to trade with two customers, there are three states of the world to consider for the supplier: With probability θ^2, both customers have high demand, with probability $2\theta(1-\theta)$ only one of the customers has high demand, and with probability $(1-\theta)^2$ both customers have low demand. The benefit of diversification results from the assumption that P_H is high enough for the supplier to pay its debt in the second state when the relationship with one of the customers is terminated. Under equity financing, with diversification, surplus from trade with one small customer is given by:

$$S_{E_i} = \frac{P_i - C - D_c - L}{2}$$

provided that

$$S_{E_i} > 0, \quad \forall i \in \{L, H\}$$

The transfer from the customer to the supplier under equity financing is given by

$$\frac{S_{E_i}}{2} + \frac{L}{2} = \frac{P_i - C - D_c + L}{4}$$

Note that with equity, the supplier's bargaining with one customer is independent from the other one. With probability θ^2, the supplier trades with both customers;

with probability $2\theta(1-\theta)$ trade happens with only one of the customers and with probability $(1-\theta)^2$ trade does not happen with any customer. Substituting the supplier's share from trade surplus into its value function yields:

$$V_E^d = \theta^2 \left[\frac{P_H - C - D_c + L}{2}\right] + 2\theta(1-\theta)\left[\frac{P_H - C - D_c + 3L}{4}\right] + (1-\theta)^2 L + Y - I \qquad (1.22)$$

The supplier's problem with equity is simpler than the one with debt financing because there is no risk of liquidation. As a result, the outcome of the bargaining with one customer is independent of the bargaining with the other customer. In case of debt financing, the bargaining payoffs depend on weather the trade with the other customer happens or not. Consider the first case where demands for both customers' products are high. Conjecturing that in equilibrium, the supplier trades with the first small customer, the surplus from the trade with the second small customer is given by:

$$S_{D_2} = \frac{P_H - C - D_c - L}{2}$$

provided that

$$S_{D_2} > 0 \qquad \text{and} \qquad \frac{S_{D_1}}{2} + L > D_s \qquad (1.23)$$

In equilibrium, the transfers from each customer to the supplier are equal and given by:

$$\frac{S_{D_1}}{2} + \frac{L}{2} = \frac{S_{D_2}}{2} + \frac{L}{2} = \frac{P_H - C - D_c + L}{4} \qquad (1.24)$$

Now consider the second case where demand for only one of the customer's product is high. Here the underlying assumption is that trade with one customer

is enough to pay for the face value of debt. Therefore, there is no risk of liquidation. Conjecturing that trade happens with the high-demand customer, the supplier bargains with the low-demand one. The possible surplus from this trade is given by:

$$S_{D_1} = \frac{P_L - C - D_c - L}{2}$$

provided that

$$S_{D_1} > 0 \qquad \text{and} \qquad \frac{S_{D_2}}{2} + \frac{L}{2} > 0 \tag{1.25}$$

Note that if the customer has high debt ($D_c \geq P_L - C - L$), the first condition in (1.25) cannot be satisfied, and trade does not happen. The second condition ensures that the equilibrium payoff is enough for the supplier to pay the face value of debt. Next, the supplier bargains with the high-demand customer conjecturing that trade does not happen with the low-demand customer. Here, the bargaining outcome determines whether the supplier will be liquidated or not. In this case, the trade surplus can be written as:

$$S_{D_2} = \frac{P_H - C - D_c + L}{2} - D_s \tag{1.26}$$

provided that

$$S_{D_2} > 0 \tag{1.27}$$

In equilibrium, the transfers from high-demand customer to the supplier is given by:

$$\frac{S_{D_2}}{2} + D_s = \frac{P_H - C - D_c + L + 2D_s}{4} \tag{1.28}$$

Finally, the supplier is liquidated in the state where demand is low for both

customers. Given the equilibrium, one can solve for the face value of the supplier's debt:

$$D_s = \frac{I - (1-\theta)^2 L}{\theta(2-\theta)}$$

Here, I assume that P_H is high enough to satisfy the conditions in (1.23) and (1.27), which can be rewritten after substituting the face value of debt as:

$$\frac{P_H - C - D_c + 3L}{4} > \frac{I - (1-\theta)^2 L}{\theta(2-\theta)} \tag{1.29}$$

and

$$\frac{P_H - C - D_c + L}{2} > \frac{I - (1-\theta)^2 L}{\theta(2-\theta)} \tag{1.30}$$

Assuming that P_H is high enough to satisfy the conditions in (1.29) and (1.30), the expected value of the supplier's shareholders is given by

$$V_D^d = \theta^2 \left[\frac{P_H - C - D_c + L}{2} - D_s \right] + 2\theta(1-\theta) \left[\frac{P_H - C - D_c - 2D_s + L}{4} \right] + \theta(2-\theta)Y \tag{1.31}$$

To simplify the notation, let

$$A = \frac{P_H - C - D_c}{2}$$

Substituting this back into shareholders' value under different financing and diversification pairs yields:

$$V_D^d = \theta A + \theta(2-\theta)Y + \left(\frac{\theta}{2} + \frac{(1-\theta)^2}{2-\theta} \right) L - \frac{I}{2-\theta}$$

$$V_D^c = \theta A + \theta Y - \frac{I - (1-\theta)L}{2}$$

$$V_E^c = V_E^d = \theta A + \left(1 - \frac{\theta}{2} \right) L + Y - I$$

The supplier compares the value of its shareholders under different financing and diversification pairs. The optimal pair depends on the continuation value such that

$$V_D^d > V_D^c \Rightarrow Y > \frac{I-L}{2(2-\theta)(1-\theta)} = Y_1 \tag{1.32}$$

$$V_D^c > V_E^d = V_E^c \Rightarrow Y < \frac{I-L}{2(1-\theta)} = Y_2 \tag{1.33}$$

$$V_D^d > V_E^d = V_E^c \Rightarrow Y < \frac{I-L}{(2-\theta)(1-\theta)} = Y_3 \tag{1.34}$$

Lemma 2 *Given $I > L$, $Y_1 < Y_2 < Y_3$ holds.*

Proposition 4 *Suppose $D_c \geq P_L - C - L$ and P_H is high enough to satisfy the conditions in (1.29) and (1.30), then the supplier's value under different financing and dependence outcomes are ranked as follows:*

1. *If $Y > Y_3 > Y_2 > Y_1$, then $V_E^d = V_E^c > V_D^d > V_D^c$*
2. *If $Y_3 > Y > Y_2 > Y_1$, then $V_D^d > V_E^d = V_E^c > V_D^c$*
3. *If $Y_3 > Y_2 > Y > Y_1$, then $V_D^d > V_D^c > V_E^d = V_E^c$*
4. *If $Y_3 > Y_2 > Y_1 > Y$, then $V_D^c > V_D^d > V_E^d = V_E^c$*

For the values of continuation that satisfy $Y_3 > Y > Y_1$, diversification with debt is optimal. In this case, the supplier enjoys both the bargaining benefits of debt financing and a higher expected continuation value (i.e. lower cost of liquidation). When the continuation value is high such that $Y > Y_3$, the expected cost of liquidation overcomes the bargaining benefits of debt, and the supplier prefers equity financing over debt. Figure 1.2 summarizes the optimal financing and diversification pairs for possible continuation values.

Note that the threshold value of Y above which equity is preferred over debt in Proposition 3 (Y_H) is equal to Y_2. Without diversification, for debt to be preferred, the continuation value should be below Y_2. However, if the supplier is allowed to diversify its production, this threshold is increased to Y_3, and debt is still preferred over equity for $Y_3 > Y > Y_2$. This extension shows that by decreasing the expected cost of early liquidation, diversification allows the supplier to take advantage of the bargaining benefits of debt for a wider range of continuation values.

Corollary 5 $0 < \frac{\partial Y_1}{\partial I} < \frac{\partial Y_2}{\partial I} < \frac{\partial Y_3}{\partial I}$ *and* $0 > \frac{\partial Y_1}{\partial L} > \frac{\partial Y_2}{\partial L} > \frac{\partial Y_3}{\partial L}$.

All three thresholds Y_1, Y_2 and Y_3 increase with the supplier's cost of production, but the threshold, above which equity is preferred over debt (Y_3) is the most sensitive to changes in investment. A higher initial investment can make the supplier favor debt over equity. Conversely, all threshold values decrease with liquidation value, again with Y_3 being the most sensitive threshold.

1.5 Testable Implications

Proposition 1 demonstrates that when customer debt is low, the supplier prefers debt over equity, regardless of the value of continuation and the probability of low demand. Low customer debt allows for the customer to invest into supplier's product and still have a positive payoff from trade. This ensures that trade happens regardless of the future demand, and eliminates any risk of supplier being liquidated early. With the cost of early liquidation being zero, the supplier increases its payoffs with bargaining benefits of debt. On the other hand, high customer debt

increases the probability of the relationship being terminated and the supplier being liquidated. In this case low debt becomes optimal for the supplier.

Prediction 1 *High customer leverage is associated with low supplier leverage.*

Proposition 2 and 3 show that continuation value is an important parameter that affects the supplier's financing decision when customer debt is high. The model predicts that if the supplier has future value that it cannot pledge for its current debt, then the supplier cannot take the risk of early liquidation. In this case, equity becomes more likely.

Prediction 2 *Suppliers with significant future growth options are more likely to hold less debt if their major customers are highly leveraged.*

Proposition 2 and 3 demonstrate that in all three regions of customer debt, the difference between the supplier's value under debt and equity financing increases with the amount of initial investment I and decreases with the liquidation value L.

Prediction 3 *Given that the customer has high debt, suppliers are more likely to prefer debt over equity if the relationship requires large upfront investments which are expected to pay off in the future; and are more likely to prefer equity over debt if the liquidation value of the product is high.*

Note that one empirical proxy for the initial setup costs is the amount of sales that the supplier makes to the customer. The larger the sales, the higher the specialization and investments required for the tailored production. R&D expenditures and industry concentration can also measure the degree of product specialization.

For financing to be an important decision, it is essential that the supplier's product cannot be deployed without any cost. Even with zero customer debt, the bargaining benefit of debt financing is realized only if $L < I$. Otherwise, the shareholders' value under debt and equity are the same. However, given $L < I$ and the customer has high debt, the supplier's payoff is affected by the liquidation value more under equity rather than debt.

Suppose that the customer debt satisfies $D_c \geq P_L - C - L$, and the supplier's and the customer's bargaining powers are given by the parameters α and $1 - \alpha$.

Proposition 5 *For continuation values* $Y < (>) \frac{(1-\alpha)(I-L)}{(1-\theta)} = Y_H^{\alpha}$, *the supplier prefers debt (equity).*

The threshold value of continuation above which equity is preferred over debt increases with customer's bargaining power. In other words, if the customer has more bargaining power, the supplier adjusts its bargaining power using debt, which makes equity less likely.

Corollary 6 $\frac{\partial Y_H^{\alpha}}{\partial(1-\alpha)} > 0$.

Prediction 4 *If the customer has more bargaining power, the supplier is less likely to prefer equity over debt.*

There are couple of possible proxies for the customer's bargaining power. For instance, a high industry concentration can be associated with high bargaining power. Also, if the supplier industry is competitive, the customer might be able to switch to another supplier, which increases its bargaining power. On the other hand, if the

customer's purchases have been concentrated in a single supplier, the switching costs for the customer might be high, which in turn decreases the customer's bargaining power.

Finally, Proposition 4 shows that diversification can decrease the risk of early liquidation and helps the supplier to enjoy bargaining benefits of debt.

Prediction 5 *If the supplier has the opportunity to work with multiple customers, the supplier is more likely to issue debt and diversify its customer portfolio.*

1.6 Discussion and Conclusion

I present a model which studies the role of customer risk in suppliers' financing choice. The base model predicts that when suppliers face with a high-risk customer, they prefer equity over debt. The extended model analyzes the supplier's choice between concentrating on a single major customer or diversifying into multiple customers. I show that by decreasing the risk of premature liquidation, diversification allows for the supplier to take advantage of the bargaining benefits of debt.

In this simple model, the supplier takes customer debt as given, and the customer does not consider its relationship with the supplier while deciding on its financing. Although, suppliers might collectively have an impact on the customer's decision, it is unlikely that a large customer's capital structure is affected by its relationship with a single small supplier. Nevertheless, it is useful to discuss the possibility of joint determination of customer and supplier debt.

If the customer and the supplier decide on their capital structures simultaneously, then the relative magnitudes of continuation values become an important

determinant of each firm's choice of financing. If both firms have negligible continuation values, then they both issue debt and liquidate in the low-demand state. With differential continuation values, the firm with high continuation value issues equity, and the one with low continuation value issues debt, which coincides with the case given in Proposition 3.

Figure 1.1: Timeline of The Events

This figure presents the timeline of the events of the model. The first period involves the supplier producing one unit of output for the customer. At time 0, the supplier borrows an amount equal to I or issues equity in order to finance this production. At time 1, the customer and the supplier share the profits from the sale of the final good. The customer's and supplier's debt are due at time 1.

Supplier

Production decision	Production completed	
0	1	2
Cost of production (I)	Bargaining Debt due (D_s)	L (liquidation) or Y (continuation)

Customer

	Price realized $\{P_H, P_L\}$	
0	1	2
	Investment decision (C) Debt due (D_c)	

Figure 1.2: Diversification versus Concentration and The Choice of Financing

This figure presents the optimal financing and diversification pairs for different ranges of supplier's continuation value.

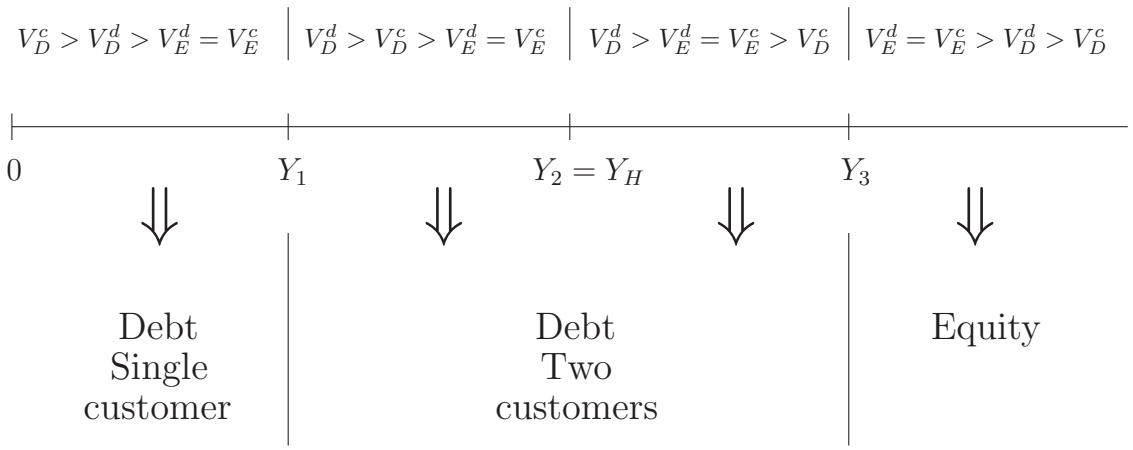


Table 1.1: Summary of the Solution to the Base Model

This table summarized the supplier payoffs from bargaining for each state under different methods of financing. Case 1, Case 2 and Case 3 coincide with *Low, Medium* and *High Customer Debt* cases, respectively.

		Supplier Payoff		
State ($T=1$)	Financing ($T=0$)	Case 1 $0 \leq D_c \leq P_L - C - I$	Case 2 $P_L - C - I < D_c < P_L - C - L$	Case 3 $D_c \geq P_L - C - L$
High-demand (θ)	Debt	$\frac{P_H - C - D_c - I}{2}$	$\frac{P_H - C - D_s - D_c}{2}$	$\frac{P_H - C - D_s - D_c}{2}$
	Equity	$\frac{P_H - C - D_c + L}{2}$	$\frac{P_H - C + L - D_c}{2}$	$\frac{P_H - C + L - D_c}{2}$
Low-demand ($1-\theta$)	Debt	$\frac{P_L - C - D_c - I}{2}$	No trade	No trade
	Equity	$\frac{P_L - C - D_c + L}{2}$	$\frac{P_L - C + L - D_c}{2}$	No trade
		Always Debt	$\frac{I - \theta L - (1-\theta)(P_L - C - D_c)}{2(1-\theta)} = Y_M$	$\frac{I - L}{2(1-\theta)} = Y_H$

2 Does Customer Risk Affect Suppliers' Capital Structure Decisions?

2.1 Introduction and The Related Literature

2.1.1 Motivation

When a supplier is dependent on the business of a major customer, it carries the risk of a sharp decline in sales if the customer experiences financial distress. Furthermore, if financial distress results in customer bankruptcy, it can cause both termination of long-term contracts between the customer and the supplier as well as loss of relation-specific investments made by the supplier. While the impact of customer financial distress and bankruptcy on supplier stock returns have been documented, their implications for capital structure have not been investigated. This study aims to fill this gap by analyzing how financial risk of major customers can affect suppliers' capital structure choices.

I hypothesize that suppliers use debt financing more conservatively when their major customers are more likely to experience financial or economic problems. Using leverage, volatility of stock returns and credit ratings as proxies for customer risk, I show that there is a negative relationship between supplier leverage and customer risk proxies, both in the cross section and in time series. This negative effect is also prominent in the net debt issuance activity of suppliers, and it is not driven by firms rebalancing their leverage ratios or decrease in suppliers' demand for external financing. Comparing the impact of customer risk on different supplier groups shows

that firms that are young, and firms that operate in concentrated industries are more sensitive to changes in customer risk. Suppliers with risky customers are more likely to raise equity during the first two years of the relationship. The results from further analyses suggest that customer risk affects suppliers' capital structure through its impact on supplier's risk. Using changes in credit ratings, I find that there is a lead-lag relationship between customer and supplier credit rating changes. Also, suppliers experience an increase in volatility of their stock returns after they start a new relationship with a risky customer. Overall, the results emphasize the importance of major customers in firms' capital structure decisions.

There are two important channels through which a customer in distress can affect its supplier(s). First, the customer could postpone payments to the supplier for the products that have already been delivered. For instance, during the recent economic recession, many auto parts manufacturers experienced financial difficulties because they could not receive payments from the Big Three automakers. The suppliers group estimated that payments from the Big Three to auto parts manufacturers decreased to $2.4 billion in March 2009, from a monthly average of $8.4 billion in the fourth quarter of 2008.[1] Second, the customer could terminate the relationship, thus forcing the supplier to look for a new customer, and possibly lose investments specific to the relationship. For example, after filing for bankruptcy in 2003, Kmart terminated its 10-year supply agreement with Fleming Companies, whose purchases

[1] "The Auto Industry's Other Crisis", *Businessweek*, 13 March 2009.

accounted for about 20% of Fleming's 2002 revenues.[2] Consistent with these predictions, Hertzel et al. (2008) find that firms' financial distress has significant effect on their suppliers' stock returns during pre-filing period and on filing date. Interestingly, they cannot find evidence for distressed suppliers affecting customer stock returns, which they attribute to customers anticipating and/or causing the financial distress of their suppliers.

Both the anecdotal and empirical evidence suggest that financial distress of major customers can have significant negative impact on the operations and valuation of their suppliers. In such times, having a conservative capital structure (i.e. low debt) can help suppliers to avoid themselves from experiencing financial problems. For instance, by having unused debt capacity (i.e. bank line of credit) or cash, suppliers can minimize liquidity and debt-overhang problems when the financially distressed customer delays the payment or fails to fulfill it. Also, because it does not involve any interest payments, *ex-ante* equity financing can prevent the supplier from being inefficiently liquidated in case of customer financial distress. I formalize some of these ideas in a simple two-period model presented in the first chapter.

I begin my empirical analysis by testing the impact of customer risk on suppliers' capital structure. I use long-term credit ratings, industry-adjusted stock return volatility, and industry-adjusted leverage in order to proxy for customer risk. I find that, on average, supplier leverage is negatively associated with customer risk when credit rating and stock return volatility are used as proxies. The pair-level fixed ef-

[2] "Kmart ends deal with food supplier Fleming", *USA Today*, February 5 2003. Following this termination, Fleming filed $1.5 billion in claims against Kmart for the warehouses that Fleming built for Kmart services ("Big Grocery Supplier Files for Bankruptcy Protection", *The New York Times*, April 2 2003).

fects and first-differences regression results suggest that this relationship continues to hold in time series as well, particularly for customer credit rating and customer leverage. Results show that deterioration in customer financial health is also associated with lower net debt issuance. Analyzing the first years of business relations is useful because during those years the supplier's need for external financing is expected to be high, which allows for investigating the supplier's choice between debt and equity. I find that during the first two years of the relationship, suppliers with high-risk customers are more likely to raise equity rather than debt. These results collectively support my prediction that suppliers maintain low leverage when their existing customers' financial risk is high.

Customer distress might affect some suppliers differently. For instance, suppliers that are financially constrained will find it more difficult to recover from the negative impact of customer distress. Firms in concentrated industries are more subject to strategic interactions that might weaken them in downturns. Also, firms that operate in concentrated industries are likely to have specialized products, which makes switching to another customer more costly. Comparing the impact of customer risk on different supplier groups shows that younger firms, and firms in concentrated industries are more sensitive to changes in customer risk. The cross-sectional variation in changes in supplier leverage is consistent with the idea that suppliers respond to changes in customer risk more when the cost of losing a major customer is high.

If customer financial risk has a direct impact on the supplier, then the supplier's credit ratings and/or volatility of stock returns should reflect the changes in customer risk. Consistent with the risk transfer argument, I find that customer credit

rating changes predict supplier credit rating changes, but not vice versa. While this result holds using both annual and monthly data, the monthly results show that supplier credit rating changes follow changes in customer ratings with one-month lag. By focusing on a major customer, suppliers become exposed to uncertainties in customers' business. I use volatility of stock returns as a measure of uncertainties surrounding the customer's and the supplier's business, and test whether starting a new relationship with a high-volatility customer affects the supplier's stock return volatility. I specify a three-year event window around the year that a new customer is added to the supplier's portfolio. Results show that conditional on the customer having high *ex-ante* stock return volatility, supplier stock return volatility increases after the relationship starts.

The model presented in the first chapter predicts that by decreasing the risk of early liquidation, diversification can increase the supplier's capacity to hold more debt. Consistent with this, the supplier might diversify its sales rather than decreasing its leverage as a response to an increase in customer risk. However, if there are relation-specific investments involved, the supplier might not be able to decrease sales to its major customer because of high switching costs. My results from survival analysis show that the business relations are more likely to end after downgrades in customer credit ratings. This result holds only for one-notch rating changes, which suggests that termination is less likely after a significant deterioration in customer financial health. Although, it is not possible to determine whether the customer or the supplier initiates the termination, these results suggest that the supplier is more likely either lose a major customer or to terminate its relationship with the

customer after credit rating downgrades.

In order to test the robustness of the net debt issuance results, I conduct two tests. First, I check whether the decrease in debt issuance activity is caused by high-leverage suppliers who are likely not to issue debt in order to bring their capital structure closer to the target. I could not find a significant difference in average net debt issuance activity of suppliers with different leverage ratios. Second, in order to rule out the possibility that suppliers issue less debt because of the reduced demand, I use a financial deficit variable and capital expenditures to proxy for the supplier's demand for external financing. Results are not affected by these controls. I also conduct some robustness tests regarding the first differences specification. The reverse exercise shows that changes in supplier risk do not affect customer leverage. The main results survive after controlling for customer industry-year fixed effects. Also, controlling for various customer characteristics do not affect the results. These tests help to address some of the endogeneity problems related to omitted variable bias.

A major customer's distress can significantly restrict the supplier's financial flexibility by generating liquidity shortages. In this case, major capital structure changes that expand the supplier's access to capital can alleviate the negative impact of customer's distress on the supplier. Accordingly, I investigate changes in customer characteristics around supplier IPOs. I find that new customers added over the four years following the supplier IPO have higher leverage, lower credit ratings and higher stock return volatility compared to customers that exist prior to the IPO. The results are not likely to be driven by the reversals in the performance of customer

industries. This constitutes further evidence for the negative relationship between customer risk attributes and supplier leverage.

I also investigate the impact of customer risk on suppliers' performance. Using sales growth and stock returns as performance measure, I find that during a downturn in the customer industry, suppliers that are dependent on their high-leverage customers perform poorly compared to suppliers with low-leverage customers. Thus, the data confirms the main premise of the paper, namely, that financial distress of major customers has significant negative impact on their suppliers.

Since, operating risk is associated with high bankruptcy probability, firms with volatile cash flows are expected to hold less debt in the presence of bankruptcy costs. Parsons and Titman (2008) provide a comprehensive review of the empirical capital structure literature. They conclude that the empirical findings for the impact of cash flow volatility on target leverage is mixed. For instance, while Bradley et al. (1984), Wald (1999), and Booth et al. (2001) document a negative relation between cash flow volatility and leverage, other studies have found either the opposite (Toy et al. (1974), Long and Malitz (1985)) or no significant relation between debt ratios and cash flow volatility (Titman and Wessels, 1988). For the suppliers dependent on their major customers, an important source of operating risk is the ability of the customer to make payments, and continue with the business relation. This paper contributes to the empirical capital structure literature by investigating the impact of risks associated with suppliers' revenues resulting from their major customers. My results are consistent with the negative relationship between operating risk and debt suggested by the capital structure literature.

The remainder of the chapter is organized as follows. Section 2.2 describes the data and explains the empirical methodology. Section 2.3 reports the main results from the tests of the impact of customer risk on supplier capital structure using cross sectional, fixed effects and first differences regression models. Section 2.4 investigates the link between customer risk and supplier capital structure, particularly the risk transfers from customer to supplier. Section 2.5 provides the results from robustness tests. Section 2.6 reports the results from further analysis, mainly changes in customer risk profile around supplier IPOs, and supplier performance during customer industry downturns. Section 2.7 summarizes the findings and concludes.

2.1.2 Literature Review

Financial distress is a costly event, and the possibility of financial distress affects the operating performance of a firm through various stakeholder relations. Starting with Titman (1984), a literature has evolved to investigate the conflicts between a financially distressed firm and its stakeholders, and how those conflicts may affect the firm's capital structure decisions.[3] The main message of this literature (i.e. Titman (1984), Titman and Wessels (1988), Banerjee, Dasgupta and Kim (2008)) is that those firms whose liquidation can impose high costs on their customers and other non-financial stakeholders choose to have lower leverage ratios compared to others.

While it is believed that firms adjust their capital structure in order to avoid their business relations being affected by their own financial distress risk; non-financial

[3]A broader stream of the financial distress literature focuses on the causes of financial distress and how to measure the costs and benefits of it. Examples include Altman (1984), Opler and Titman (1994), Andrade and Kaplan (1998).

stakeholders' responses to such risks have not received much attention. The current paper aims to fill this gap by investigating the changes in suppliers' capital structure with customer risk. Under certain conditions (i.e. if the customer operates in a concentrated industry) a supplier might be willing to (or might have to) work with a risky customer, but depending on such customers can have negative consequences (such as late payments, non-payments and/or loss of a major business relationship) for the supplier in the event that the customer experiences distress. Given such risks the supplier might find it optimal to decrease its own financial risk (i.e. by decreasing its own leverage) in order to avoid problems that might result from its relation with the risky customer.

Hertzel et al. (2008) investigates the wealth effects of distress and bankruptcy filing for suppliers and customers of filing firms. By analyzing the stock returns of rivals, suppliers, and customers, they find that firms' financial distress have significant effect on their rivals' and suppliers' stock returns during the period before the filing and on filing date. However, when they investigate the financially distressed firms' impact on their customers, they do not find any significant effect. They attribute this to customers anticipating and/or causing the financial distress of a supplier. Kolay, Lemmon and Tashjian (2012) conduct an empirical examination on a sample of 269 firms which went bankrupt between 1980 and 2009 and a corresponding sample of their suppliers and customers. They find that suppliers which depend on their filing customer to generate a larger portion of their sales, and which have higher product specialization have a higher level of contagion. They estimate that a 10% lower chance of successful customer reorganization translates into $24.5 million

extra loss of market capitalization for the suppliers.

The existing literature shows that the strength and dependence of business relations affect firms' capital structure. Kale and Shahrur (2007) argue that a firm can use less debt in its capital structure in order to induce its suppliers and customers to undertake relation-specific investments. Using R&D investment as a proxy for the amount of relation-specific investment, they show that customers and suppliers use less leverage when they are in such a relationship. Banerjee, Dasgupta and Kim (2008) argue that durable goods producing firms that purchase a higher portion of their inputs from dependent suppliers maintain lower leverage ratios in order to encourage their suppliers to commit more relation-specific investments. Using the ratio of sales to major customers as a proxy for supplier dependence, they show that firms in durable goods industries hold less leverage when they depend on a single customer; and customers hold less leverage when they have suppliers dependent on them. This paper complements the literature on customer-supplier relations by examining whether the financial distress risks of their major customers affect the capital structure decisions of suppliers.

While the nature of business relations and their impact on capital structure have been investigated, little empirical evidence exists on how financial characteristics of firms in business relations might affect each other's capital structure decisions. One exception is Chu and Wang (2011), who investigate leverage relationships of firms along the supply chain, and find that suppliers' leverage is positively related to their customers' leverage. They argue that firms use leverage as a bargaining tool against other firms that they are in a business relationship with. Consistent with this, they

find that the positive relationship is stronger when customer firms have more ex-ante bargaining power. Different than Chu and Wang (2011), the current paper focuses on financial distress channel rather than bargaining power theories. There are two major reasons for why the results in this paper are different than those in Chu and Wang (2011). First, the hypothesis that I present in this paper build on the assumption that the supplier is dependent on the customer firm in its revenues. As a result, I restrict my sample to firms with customers whose purchases constitute a significant share of total sales and those have been in a relationship with the same customer for a certain period of time, whereas Chu and Wang do not use the information on sales or duration. Second, I focus on manufacturing suppliers because the mechanism proposed in this study through which the supplier is affected by its customers' financial distress requires the supplier to have specialized production. In general, asset specificity is low in services sector, which makes it more difficult to detect a relationship between supplier capital structure and customer characteristics.

Brown, Fee and Thomas (2009) investigate the impact of leveraged buyouts (LBOs) on the bargaining power of firms with their suppliers. They find that leverage-increasing transactions result in significant negative supplier announcement returns. They also show that the specific suppliers, who are the ones most susceptible to bargaining pressures, experience decreases in their profit margins following their customers' LBOs. While one might expect suppliers to increase their own debt in response to increases in their customers' bargaining power, Banerjee et al. argue that once the supplier becomes dependent on the customer, it is difficult to use debt as a bargaining tool. Although, debt could increase the bargaining power in general,

it can also affect the supplier negatively. For instance, if the customer experiences debt overhang, it might not be able to raise the financing needed to expand, improve or continue the line of business that it has with the supplier. This might cause the supplier to experience liquidity problems until it finds a new customer. In such cases, having cash holdings and unused debt capacity can help the supplier to manage the downturn.

Titman and Wessels (1988) test the theoretical determinants of capital structure such as asset structure, non-debt tax shields, growth, uniqueness, industry classification, size, earnings volatility and profitability. Besides these firm-specific determinants of capital structure, empirical studies find that there are also outside factors such as industry average leverage (Welch (2004) and Frank and Goyal (2007)) that affect capital structure. Leary and Roberts (2011) draw attention to the role of peer firms in shaping a firm's financial policy. They show that peer firms' capital structure have a large and robust impact on a firm's own capital structure decision. This study complements the literature by introducing customer risk as another outside factor that might affect a firm's financing decisions.

2.2 Data and Empirical Methodology

2.2.1 Data and Sample Construction

In accordance with the Statement of Financial Accounting Standards (SFAS) no. 14 and 131, public firms are required by the SEC to report the sales to and identity of

any customer that comprises more than 10% of a firm's consolidated sales revenues.[4] These disclosures are made as part of firms' business segment information. Prior to 1997, Regulation SFAS No. 14 governed segment disclosure. SFAS No. 131 issued by the FASB in June 1997, has been effective for fiscal years beginning after December 15, 1997. As of 1998, firms are no longer required to report the identity of their principal customers but they still need to report the sales to each of them, and many firms continue disclosing the identity of their principal customers.

While the customer information is available in the Compustat industry segment files, it is not in an immediately usable format. The database reports only the name of the customer (not CUSIP or other identifiers), and sometimes it reports only the abbreviated versions of the names. This requires either manual matching of customer names with their identifiers or using matching algorithms. In order to generate a list of potential matches, I use a computer algorithm.[5] Then, I visually inspect the matches to determine if the customer is correctly identified. While doing this, I use the industry information and check whether the customer is a subsidiary of another company.

In my analysis, I focus on manufacturing suppliers because the mechanism proposed in this study through which the supplier is affected by its customer's financial distress requires the supplier to have relation-specific investments. Because of low asset specificity, such costs might not be significant in services sector, which makes

[4]Under REG S-K (17 C.F.R. 229.101) (Item 101), "the name of any customer and its relationship, if any, with the registrant or its subsidiaries shall be disclosed if sales to the customer by one or more segments are made in an aggregate amount equal to 10 percent or more of the registrant's consolidated revenues and the loss of such customer would have a material adverse effect on the registrant and its subsidiaries taken as a whole."

[5]STATA's record linking program "reclink" written by Michael Blasnik.

it difficult to detect a relationship between supplier capital structure and customer characteristics for non-manufacturing suppliers. Table A2 reports the 2-digit SIC industry distribution of suppliers in the sample. The sample weight of industries are similar to their weights in Compustat universe.

The Compustat Customer Segment database includes both public and private customers. I drop all observations without any customer name, with customer names including "CUSTOMERS" (i.e. 2 customers) and those that are related to U.S. Government. Between 1976 and 2011, there are 65,475 manufacturing supplier firm years in the Compustat Customer Segment data with a valid customer name. After matching customer names with Compustat companies, I obtain 33,706 observations with non-missing customer and supplier assets.

After 1997, firms are not required to reveal the identity of their major customers but they are still required to report the amount of sales to each of them. This is one drawback of the customer segment data, which does not exist for the period before 1997, when firms are expected to report both the identity of their customers and the amount of sales to them.[6] Banerjee, Dasgupta and Kim (2008) focus on the early years of the dataset, mainly from 1979 to 1997. One advantage of their study is that they do not use customer characteristics when they are analyzing the impact of sales to major customers on firms' capital structure. The only customer-specific information that they use is whether it is a government entity or a non-

[6]Ellis, Fee, and Thomas (2009) study the characteristics of firms that choose to report the identity of their major customers, even when they are not required to do so. They find that firms in less competitive product markets are significantly less likely to voluntarily reveal information about customers. They argue that because of strategic interactions among rivals, proprietary costs of information disclosure is higher for firms operating in such markets.

government firm. Furthermore, by focusing on the period before 1997, they can identify all sales to major customers correctly and substitute the years without any sales to major customers with zero. This delivers a larger and more balanced data set. Unfortunately, when the interest is the characteristics of major customers, the sample is restricted to Compustat firms only, and the years without any major customers reported cannot be used. In order to increase the sample size and obtain data on longer business relations, I use supplier years before and after 1997. Note that the sample after 1997 is composed of suppliers who voluntarily report the identity of their major customers.

For customer risk to affect a supplier's future viability and choice of financing, it is necessary that either the customer's purchases constitute a large fraction of the supplier's total sales and/or the supplier produces an output that is specific to the customer. The Customer Segment data provides two dimensions that one can use in order to assess the strength of identifiable relationships: the length of the relationship and the amount of sales to the major customer. I use both of these measures in order to determine the significant relationships and eliminate any errors that might result from data or matching. There are suppliers who report major customers even though their purchases constitute less than 10% of total sales. Following Banerjee, Dasgupta and Kim (2008), I use 10% as the cutoff point, but in order to avoid any endogeneity problems, I use historical mean of sales to a major customer rather than current sales. Only for the first year of the relationship, I use contemporaneous sales. This screening helps to eliminate errors that might result from data or matching, and allows for those customers whose purchases decrease below 10% in

one year to be included in the data. After determining those pairs with significant amount of trade, I restrict the sample to those with at least three consecutive years of relationship, which leaves out the short-lived relationships. Finally, I require the customer not to disappear for more than one year.

The initial sample of Compustat firms consists of all non-financial, non-public and non-utility (excluding observations with SIC codes 6000-6999, 9000-9999 and 4900-4999) firm-year observations in the annual Compustat database between 1976 and 2011. I require that all firm-years have non-missing data for book assets while all multivariate analysis implicitly requires non-missing data for the relevant variables. Ratio variables are winsorized at the five percent level to lessen the effects of outliers. In order to rule out the possible impact of changes in market values, I conduct my analysis using book leverage ratios.[7]

Supplier Leverage is defined as book value of total debt (long-term debt plus debt in current liabilities) divided by book value of total assets. *Ln(Sales)* is the natural logarithm of total sales. *Market-to-Book* is defined as the ratio of market value to the book value of assets. *ROA* is the operating income before depreciation divided by total assets. *Tangibility* is PPE divided by total assets. *R&D-to-Assets* is total R&D expenditures divided by total assets. This variable is replaced with zero when R&D expenditures are not reported, and *R&D Dummy* takes zero for those observations and one otherwise. *Net Debt Issuance* is the change in total debt divided by lagged total assets. *Net Equity Issuance* is the change in book equity minus the change in balance sheet retained earnings. These variables are formally

[7]Cohen and Frazzini (2008) show that customer stock returns predict future supplier returns. In this case, low customer market leverage might predict low supplier market leverage.

defined in Table A1.

I use three different variables to proxy for customer risk: credit rating, stock return volatility and leverage. *Customer Rating* is the S&P long-term issuer credit rating measured at the beginning of the supplier fiscal year. The credit rating variable takes a value between 1 and 22, where 1 coincides with rating AAA and 22 coincides with rating D. This variable captures the capacity of the customer to meet its financial commitments, and therefore downgrades are expected to proxy for the deterioration in customers' financial health. *Volatility of Stock Returns* is defined as the standard deviation of monthly stock returns (adjusted for median industry return) over the twelve months prior to the beginning of the supplier's fiscal year. This variable aims to capture the instability of the customer's business environment and the uncertainties surrounding it. Finally, I use *Industry-Adjusted Customer Book Leverage* as the last proxy for customer risk. High leverage can cause the customer to experience debt overhang problems, which might result in reduced investment into the supplier's line of business. Andrade and Kaplan (1998) study a sample of highly leveraged transactions that subsequently become financially distressed. They find that high leverage is the primary reason for financial distress, whereas poor firm performance, industry performance and interest rate changes have negligible impact. In order to alleviate the endogeneity concerns, I use lagged customer leverage rather than current one. Note that industry adjustments are conducted using 49 Fama-French industry definitions and results are robust to using three-digit SIC industry classifications.

The final sample is composed of 14,878 supplier firm-year observations with non-

missing leverage, sales, market-to-book, ROA, tangibility, and customer leverage variables. There are 1,770 unique suppliers, 709 unique customers and 2,827 unique customer-supplier pairs.

Table 2.1 reports the summary statistics for the customer and supplier firms as well as for the relationship characteristics. In all cases, the sample is conditioned on the availability of supplier sales, ROA, tangibility, market-to-book, as well as customer and supplier leverage ratios. Panel A reports the summary statistics for the suppliers. Median supplier firm in the sample is similar to the median firm in Compustat universe in terms of size, market-to-book and ROA. Note that the number of suppliers with a credit rating is very small, and the median rating coincides with "BB".

Panel B provides summary statistics for the customer firms in the sample. One striking difference between customer firms and supplier firms is that customer firms are much larger than supplier firms, and they have higher leverage ratios. On average, customer firms are more profitable compared to suppliers, and a higher percent of their assets is tangible. The median credit rating is 6 which coincides with a rating "A".

Panel C provides summary statistics on selected attributes of business relations. *Sales Concentration* is defined as sales to a major customer as a percentage of total supplier sales, which has a sample average of 24% and a standard deviation of 15.9%. The duration for the median relationship is 5 years.

2.2.2 Empirical Methodology

The empirical analyses implicitly assume that the supplier takes customer risk as given, and the customer does not consider its relationship with the supplier while making its financing decisions. Although, it is a restrictive assumption, it is not unrealistic given the nature of the dataset being used. As a result of the data generating process, the customers in Customer Segment data are large compared to their suppliers (and an average firm in the Compustat universe). Cohen and Frazzini (2008) report that the median customer is in the 98th percentile of CRSP firms whereas median supplier is in 48th percentile. Although, suppliers might collectively have an impact on the customer's decision, it is unlikely that a large customer's capital structure is affected by its relationship with a single small supplier. The following equation summarizes the empirical model:

$$\begin{aligned} Leverage_{i,t} &= \alpha + \beta_1 Z_{j,t-1} + \beta_2 Ln(Sales_{i,t-1}) + \beta_3 MB_{i,t-1} \\ &+ \beta_4 ROA_{i,t-1} + \beta_5 Tangibility_{i,t-1} + \beta_6 R\&D_{i,t-1} + \nu_{i,j} + \varepsilon_{i,t} \end{aligned} \tag{2.1}$$

Customer risk proxy (Z_j) can be one of the three variables that measure customer risk: credit rating, stock return volatility or book leverage. Note that all explanatory variables, including customer risk proxies are lagged relative to the dependent variable. In testing the impact of customer risk on the supplier's capital structure, I use lagged customer characteristics rather than contemporaneous ones. There are two reasons for this. First, since customer and supplier industries can be simultaneously affected from the same shocks, it is likely that contemporaneous customer characteristics will be correlated with the error term in the supplier's leverage

equation. Second, there can be cases where the differences in fiscal year endings of the customer and supplier firms might worsen a possible reverse causality problem, specifically when customer leverage is used as the proxy. To see this, assume that the customer's fiscal year ending is December and the supplier's is June. When contemporaneous variables are used, firms will have the same fiscal year but the customer's financial information will span six more months into the future. Shocks to customer leverage that happen between July to December cannot affect supplier leverage measured at the end of June unless the shocks are anticipated. In this case, a significant relationship between supplier leverage and customer risk proxies might be driven by the shocks to supplier leverage that simultaneously affect customer leverage.[8]

I incorporate the traditional determinants of capital structure into the specification that are frequently used by many capital structure studies (e.g., Rajan and Zingales (1995), Baker and Wurgler (2002), Frank and Goyal (2003), and Lemmon et al. (2008)); mainly log of sales, market-to-book, profitability, tangibility, and R&D expenditures. Note that the estimates for the intercept and R&D Dummy are all suppressed to save space throughout the tables.

In Eq. (2.1) the term $\nu_{i,j}$ denotes the customer and supplier pair fixed effects. Note that using pair fixed effects has two benefits. First, fixed effects rule out unobserved time-invariant customer and supplier firm characteristics such as managerial risk aversion, governance structure or cash flow characteristics. Second, pair fixed effects help to control for relationship characteristics that might be correlated with

[8]In 5,210 observations customer and the supplier firms have the same fiscal year end month.

customer risk and supplier leverage, and might affect the main results when omitted. For instance, suppose that high-quality customers prefer high-quality suppliers, and suppliers signal their quality by holding less debt in their capital structure (Maksimovic and Titman (1991)). If high customer risk proxies for low quality, then failing to control for quality might cause customer risk to be positively associated with supplier leverage.

Another way of eliminating the unobserved time-invariant effects is to estimate the model in Eq. (2.1) in first-differences:

$$\begin{aligned}\Delta Leverage_{i,t}\ (or\ Net\ Debt\ Issuance_{i,t}) = \alpha + \beta_1 \Delta Z_{j,t-1} \\ + \beta_2 \Delta Ln(Sales_{i,t-1}) + \beta_3 \Delta MB_{i,t-1} + \beta_4 \Delta ROA_{i,t-1} \\ + \beta_5 \Delta Tangibility_{i,t-1} + \beta_6 \Delta R\&D_{i,t-1} + \varepsilon_{i,t}\end{aligned} \tag{2.2}$$

This model tests whether the changes in the extent of customer risk can help to explain the cross-sectional variation in *changes* in suppliers' capital structure. In this specification, I also use net debt issuance as the dependent variable. As opposed to changes in leverage, net debt issuances are not affected by the changes in total assets.

2.3 The Effect of Customer Risk on Financing Decisions

If customer risk is a concern for suppliers, this might be reflected in customer-supplier pairs observed in the data. Accordingly, on average, suppliers with high leverage might find it optimal to pair with less risky customers and possibly, risky customers prefer to have business with low-leverage suppliers who are more likely to

survive in an economic downturn. Customer risk can also affect suppliers' capital structure after the relationship starts. The supplier might prefer raising equity over debt in order to finance the initial relation-specific investments or adjust its leverage ratio over time as customer risk changes.

I will begin my analysis by investigating whether customer risk is related to supplier leverage in the cross-section. Table 2.2 reports the cross-sectional estimation results of the model in Eq. (2.1). The first three columns report the results with standard errors clustered at the pair level and the last three columns at the customer and supplier level. All regressions include year fixed effects.

On average, low customer credit rating and high stock return volatility are associated with low supplier leverage. In terms of economic magnitude, the impact of customer risk is not negligible. For instance, one notch decrease in customer credit rating is associated with 0.3% decrease in supplier leverage. The signs of the coefficient estimates for all the control variables are consistent with previous studies, and results are robust to clustering at the customer and supplier level. This result suggests that on average, suppliers with risky customers hold less leverage.

Note that the coefficient estimates for customer leverage are not statistically significant, but they have the expected sign. In the cross section, there are two other possible aspects of the relationship that leverage might proxy for. First, as proposed by Bronars and Deere (1991), debt can be used as a bargaining tool against stakeholders, which predicts a positive relationship between customer and supplier debt levels. Second, debt might be correlated with the unobserved characteristics (such as quality or price) that are related to the relationship.

The cross-sectional results show that on average, suppliers with risky customers have less debt. In order to understand whether this relationship holds in time-series, I illustrate the average net debt issuance and leverage of suppliers around customer rating downgrades. Panels A and B of Figure 2.1 present the unconditional averages, where the supplier's fiscal year begin at time zero. The customer downgrades happen between time -1 and time 0, the fiscal year prior to the year that net debt issuance and leverage are measured in. Panel A shows that there is a sharp decline in net debt issuance during the year and the year following the customer rating downgrades. Within two years, average debt issuance activity falls from 3% to 0.1%. Note that net debt issuance starts to recover at time 1.

Panel B illustrates the changes in supplier leverage around customer rating downgrades. The impact of downgrades is less significant for supplier leverage. There is a 1.17% decline in leverage from time -1 to time 1. Note that the impact of the decrease in net debt issuance is not reflected on leverage until the year after the downgrade. The average leverage for suppliers without customer rating downgrades also decline from time -1 to time 0, but recover afterwards. This shows that it is important to control for the economic conditions that downgrades might be correlated with.

The unconditional analyses suggest that customer rating changes affect the variation in supplier leverage and net debt issuance activity, with the impact being more prominent for net debt issuances. One potential reason for this is the simultaneous decline in total assets, which offsets the effect of reduced issuances. In order to control for the changes in other firm characteristics that might affect suppliers' cap-

ital structure simultaneously with changes in customer risk, I estimate the model in Eq. (2.1) by repeating the analysis in Table 2.2 using customer-supplier pair fixed effects. All specifications include year fixed effects. Table 2.3 reports the fixed effects estimation results, which show that there is a negative relationship between customer risk and supplier leverage when customer credit rating is used a proxy. Note that pair fixed effects do not change the economic magnitude of the coefficient estimate for customer credit rating. When customer credit rating is one notch below its relationship-average, supplier leverage is about 0.3% below its average. The coefficient estimates for return volatility and customer leverage are negative but not statistically significant.

The results for supplier leverage is consistent with the idea that suppliers use debt conservatively when their major customers are less healthy. So far, I used customer-supplier pair fixed effects in order to capture the variation in customer financial distress risk *within* a business relation. The next table presents estimation results for the first differences specification given in (2.2) to further investigate the time-series relationship between customer risk and supplier leverage. While both fixed effects and first-differences specifications remove the unobserved within-pair effects, first-differences results are easier to interpret, and are not affected by the relationship-averages of customer risk and supplier leverage.

Table 2.4 reports the results for the first-differences specification. On average, positive changes in customer credit rating and customer leverage negatively affect the changes in supplier leverage. For instance, one notch decrease in customer credit rating is associated with 0.5% decrease in supplier book leverage. The coefficient

estimates for customer stock return volatility are insignificant. Overall, the first differences results support the findings in Table 2.3.

Until now, I have not differentiated between customer distress and deterioration in customer financial health. The distinction is important because in case of customer distress, rather than decreasing leverage, the supplier might issue more debt in order to compensate the volatility in revenues caused by the customer. One way to understand the difference between the two is to use the magnitude of credit rating downgrades. In Table 2.4, I separate customer downgrade events as *1 Notch* and *More than 1 Notch*. If suppliers decrease their leverage in order to avoid future problems related to debt, then the effect should be more prominent with smaller downgrades. There are 894 and 751 instances where customer credit ratings are downgraded by one notch and more than one notch, respectively. The results suggest that there is no significant difference between 1 notch and more than 1 notch cases.

Figure 2.1 suggests that the impact of changes in customer risk is more significant for net debt issuances. The next table investigates whether debt issuance activity of suppliers change with customer risk after controlling for changes in traditional determinants of capital structure. The results in Table 2.5 show that debt issuance activity is significantly reduced during years that customer risk is relatively high. Note that the coefficient estimates for all customer risk proxies are statistically significant at either 1%, 5% or 10%. Also, the coefficient estimates in debt issuance regressions are larger in magnitude compared to those in first-differences leverage model. This suggests that the impact of changes in customer risk are reflected more

timely in the debt issuance activity compared to leverage ratios. If total assets and debt decrease simultaneously, then leverage ratios might fail to reflect the impact of customer risk.

The first years of a relationship are important because the suppliers are likely to make investments specific to the new relationship during those years. Accordingly, one would expect the suppliers' need for external financing to increases at the beginning of the relationship. Therefore, the new relationship provides a useful event around which the supplier's financing choice can be analyzed.

Table 2.6 examines this choice during the first two years of the relationship conditional on various customer risk characteristics. *Net Debt (Equity) Issuance Dummy* takes one when the net amount of debt (equity) issued exceeds 5% of total assets and zero otherwise. *Debt vs. Equity Dummy* takes one when the net amount of debt issued exceeds 5% of total assets and zero when the net amount of equity issued exceeds 5% of total assets. Results suggest that suppliers that start a relationship with risky customers are more likely to issue equity compared to those with low-risk customers. Comparing the debt-equity choice shows that among supplier that raise external financing, those with risky customers are more likely to prefer equity over debt. For instance, 1 notch decrease in customer credit rating is associated with 1% increase in the probability that the supplier will prefer equity over debt. This result is consistent with the main implication of the model presented in Chapter 1: Suppliers are more likely to prefer equity over debt when faced with a risky customer.

2.4 The Link Between Customer Risk and Financial Policy

In this section, I further analyze the impact of customer risk in order to understand the mechanism better. The first subsection investigates the cross-sectional determinants of the relationship between customer risk and supplier leverage. The second subsection analyzes the changes in supplier risk following customer credit rating downgrades, and the third subsection compares supplier stock return volatility before and after the relationship starts. Finally, the last subsection discusses the relationship between customer risk and supplier dependence.

2.4.1 Cross Sectional Determinants of Customer Risk-Supplier Leverage Relation

While the previous section focuses on identifying the response of supplier leverage to changes in customer risk, this section investigates the cross-sectional variation in this response. The empirical analyses so far assume that customers do not consider the impact of their business risk on their suppliers. For supplier capital structure to be exogenous to customer risk, the supplier should not have any impact on the customer's decisions. As a result, I expect the negative impact of customer risk on supplier leverage to be more prominent for suppliers that are young. Also, young suppliers have less stable cash flows and are subject to asymmetric information, which makes it more likely for them to experience difficulties in obtaining capital during distress periods.

The second cross-sectional variation is related to the supplier's industry concentration, which can proxy for the uniqueness of the supplier's product as well as the amount of strategic interaction in the supplier industry (Opler and Titman (1994)).

Suppliers in concentrated industries are more likely to produce specialized products. Also, in case of distress, supplier firms that operate in concentrated industries are more subject to strategic interactions that might weaken them. As a result, customer distress might affect suppliers in concentrated industries more negatively.

The concentration in the customer industry is also important for the supplier. If the supplier loses its major customer who operates in a concentrated industry, the supplier might not be able to replace the customer immediately. Therefore, I expect suppliers to be more sensitive to changes in risk if the customer operates in a concentrated industry.

In order to compare the impact of customer risk across different suppliers, I estimate the first differences model separately for different supplier groups. I split suppliers into subgroups based on (1) supplier age, (2) the Herfindahl index of sales concentration in the supplier industry, and (3) the Herfindahl index of sales concentration in the customer industry which is defined as the sum of squared market shares of industry companies.

Table 2.7 reports the results for each subgroup using credit rating as the proxy for customer risk. Changes in customer risk have the most significant impact on younger suppliers and suppliers that are in the most concentrated industries. Also, suppliers do not respond to changes in customer risk if the customer operates in a competitive industry. These results collectively suggest that suppliers that are more likely to be financially constrained and strategically weakened in case of customer distress, are more sensitive to changes in customer credit ratings.

2.4.2 Supplier Credit Ratings and Customer Credit Rating Downgrades

When their major customer is in trouble, it is natural to expect suppliers' credit ratings to be affected. For instance, after Kmart's credit rating was downgraded, Moody's said it might cut Fleming's debt ratings because Kmart was the grocery supplier's most important customer.[9]

The results of the previous section suggest that supplier leverage responds negatively to increases in customer risk. In the context of the trade-off theory of capital structure, customer risk increases the expected costs of financial distress by making failure more likely, and predicts a lower target leverage for the supplier. If this is the case, then supplier credit rating should reflect this increased cost. In order to test this, I use first differences specification, and regress lagged changes in customer credit ratings on current changes in supplier credit ratings using both the annual and monthly data. Note that the sample size is restricted to the availability of supplier credit ratings.

Table 2.8 reports the regression results estimated using the annual data. The changes in credit ratings are calculated as the difference between the rating at the beginning of the supplier's fiscal year and the rating one year prior to that. Standard errors are clustered at the pair level but similar standard errors are obtained when they are clustered at the customer and supplier level. All regressions include year fixed effects. The results suggest that changes in customer credit ratings predict changes in supplier credit ratings. For instance, the result in the second column

[9]Reuters, January 14 2002, *Kmart Shares at 34-Year-Low.*

shows that 1 notch decrease in credit ratings decreases supplier rating by 0.09-0.1 notches. Note that the results are not significant when contemporaneous changes in credit ratings are considered. When contemporaneous values are considered, it is difficult to determine whether changes in supplier ratings are followed by changes in customer ratings or vice versa. In the third column, I control for supplier and customer median industry sales growth, market-to-book and ROA. Results are robust to these controls.

In the fourth column of Table 2.8, I split customer downgrade events as *1 Notch* and *More than 1 Notch*. Results suggest that one notch decrease in customer credit rating, which is more likely to be a sign of deterioration in financial health rather than a sign of distress, does not have a significant impact on supplier credit ratings. On the other hand, more than one notch decrease in customer credit rating predicts a significant decrease of 0.27 notches in supplier credit rating. This result suggests that to the extent that changes in credit ratings reflect the change in cost of debt financing, it is more likely that cost of debt will increase in case of customer financial distress rather than in cases where financial health deteriorates.

Columns five and six of Table 2.8 report the estimation results from the regression of customer rating changes on supplier rating changes, and show that changes in supplier credit ratings do not have any impact on customer credit ratings. These results constitute evidence for the risk transmission between suppliers and their major customers. The reverse exercise shows that the direction of the risk transmission is from customers to suppliers but not vice versa.

The annual data allows controlling for changes in accounting variables over time.

However, it does not tell much about how quickly the customer credit rating changes are reflected in supplier ratings. In order to understand this, in Table 2.9 I repeat the same analysis using monthly S&P long-term credit rating data. All regressions include month fixed effects and standard errors are clustered at the pair level. As in Table 2.8, there is no significant contemporaneous relationship between customer and supplier credit rating changes. On the other hand, there is a positive relationship between current supplier credit rating changes and changes in customer ratings during the month before. One notch decrease in customer rating is associated with a 0.02 notches change in supplier rating after month effects are controlled for. Note that consistent with the results using annual data, changes in supplier credit ratings do not predict changes in customer ratings.

2.4.3 Does Supplier Stock Return Volatility Change After the Relationship Starts?

Business relations provide a useful set-up for investigating the impact of operating risk on suppliers' capital structure. If the supplier is dependent on a particular customer, a negative shock to the customer's business might be transferred to suppliers in the form of reduced operating revenues. Unless the increase in the risk of assets is borne by the debtholders, this will generate an increase in the risk of equity.

To further investigate the risk channel, I specify a 36-month event window around the year that a new customer is added to the supplier's portfolio. In my analysis, I follow Hackbarth and Morellec (2008), who investigate changes in acquirers' systematic risk around mergers and acquisitions; and Carlson, Fisher and Giammarino (2006), who investigate risk dynamics around SEOs. The test is designed as follows:

The test period covers the 12 months before the year that the relationship starts and the following 24 months, including the starting year. The supplier stock return volatility over these 24 months is compared to the volatility within the 12 months before the relationship. Each month, stock return volatility is calculated as the standard deviation of daily abnormal returns which is the difference between CRSP daily common stock returns and value-weighted market returns. Customer and supplier stock return volatility are used as independent variables, and are calculated over the year prior to the test period.

Table 2.10 reports the results. All standard errors are clustered at the pair level. The first column reports the results for all suppliers. The negative coefficient estimate of the interaction term for ex-ante supplier volatility is suggestive of mean reversion: volatility decreases after the relationship starts for suppliers with high ex-ante volatility. Consistent with credit rating results, the interaction term for ex-ante customer volatility has a positive coefficient estimate. Suppliers that begin a relationship with a high-volatility customer experience an increase in their stock return volatility after controlling for the initial volatility of their own stock returns.

The next four columns in Table 2.10 report the results for different supplier subsamples. Coefficient estimates of the interaction term between After dummy and *Ex-ante customer volatility* are positive for all subsamples. The coefficient estimates are higher for small suppliers, and suppliers with customers in highly concentrated industries, but the differences in coefficient estimates are not statistically significant. These results together with the results on credit ratings support the idea that customer risk affects supplier leverage by increasing the expected costs of financial

distress.

2.4.4 Customer Risk and Supplier Dependence

Until now, I assume that the supplier can only respond to changes in customer risk by decreasing its leverage. The simple model presented in the first chapter investigates the simultaneous determination of supplier financing and dependence given the level of customer risk. The model predicts that by working with multiple customers, the supplier can decrease the risk of early liquidation and enjoy the bargaining benefits of debt. As a result, the supplier might prefer issuing debt with multiple customers rather than issuing equity and being dependent on a single major customer.

Testing the impact of increased customer risk on the supplier's decision to diversify is not trivial. A supplier's sales concentration changes with its total sales, with the customer's demand for its product and with the amount of product that it is willing to supply. It is difficult to argue that when customer risk increases, the customer's demand for the supplier's product does not change, and the impact of customer risk on sales concentration is driven only by the supplier's decision to reduce its sales to the customer. Similarly, it is difficult to find an event that affects customer risk but does not affect the customer's demand and the supplier's total sales.

Another problem with testing the impact of customer risk on supplier sales concentration is that rather than decreasing sales, suppliers or customers might terminate their relationship after a negative shock to the customer firm. If this is the case, then the sample is biased, and the impact of customer risk on sales

concentration will be underestimated.

In order to understand the impact of customer risk on the relationship better, I analyze whether increases in customer risk affect the survival of the relationship. Note that because of the screening process, customers might still be reported by the suppliers, but sales are low such that the average sales concentration is below 10%. In Table 2.11 reports the results from the estimation of Cox proportional hazard model. The hazard of relationships being terminated after customer rating downgrades is 1.2 times that after no downgrades. Surprisingly, this result is particularly true for 1 notch changes such that when customer rating is significantly downgraded, it does not affect the probability of termination. I also investigate whether this result varies across suppliers. I split the suppliers into three groups according to their R&D expenditures and size at the beginning of the relationship. The effect is more prominent for suppliers with low R&D expenditures, whose products are less likely to be specialized. Also, the effect is stronger for small suppliers. These results suggest that the deterioration in customer health affects the future of the relationship. Furthermore, either distressed customers terminate their relationship with small and low-R&D suppliers first, or small suppliers and suppliers with less specialized products find it less costly to break up with their distressed customers.

2.5 Robustness Tests

2.5.1 Managerial Rebalancing of Leverage Ratios

One concern regarding the net debt issuance results is that they might be driven by high-leverage suppliers who are less likely to issue debt if they aim to bring their capital structure closer to the target. While this does not explain why they

decrease debt when their customers experience a credit rating downgrade, I check for this possibility by comparing the changes in debt issuance activities for different supplier leverage quartiles. Table 2.12 reports the results from the regression of net debt issuance on customer rating downgrade dummy for different quartiles. On average, there is a significant decrease (ranging between 1.1% to 2.4%) in the net debt issuance activity after customer rating downgrades. However, the p-values suggest that the coefficient estimates for quartiles 2,3 and 4 are not statistically different from the coefficient estimate for quartile 1. Therefore, results are not likely to be driven by reversals in high-leverage suppliers' capital structure.

2.5.2 Decrease in Debt Financing or Decrease in Demand for Financing?

The main results suggest that there is a negative relationship between supplier net debt issuance and customer risk. However, this does not tell us whether the decrease in leverage is associated with a change in manager's choice of financing; or the customer's demand for the supplier's product decreases, and as a result the supplier's demand for external financing is reduced. In order to differentiate between the two, I repeat my analysis in Table 2.5 but this time controlling for the supplier's demand for external financing.

Following Flannery and Rangan (2006) and Frank and Goyal (2003), I define *Financial Deficit* variable as the sum of dividend payments, investments and change in working capital minus internal cashflows. The financing deficit variable is scaled by lagged total assets as in Shyam-Sunder and Myers (1999). Table 2.13 reports debt issuance results after controlling for external financing demand. The coefficient

estimates for various customer risk characteristics are similar to those in Table 2.5, which shows that reduced demand for outside financing does not explain the decrease in debt issuance activity following increases in customer risk. Similar results are obtained when the financial deficit variable is replaced by capital expenditures.

Another way of testing whether customer risk is associated with decrease in demand is to directly test the impact of customer risk on supplier's investment. Table 2.14 reports the estimation results for the supplier's investment regression. None of the customer risk proxies has a significant impact on supplier investment.

I also investigate whether customer risk is more prominent during recession years.[10] Only one third of customer downgradings happen during recessions. In unreported results, I fail to find a significant differential impact of customer rating changes during recession years on supplier leverage. These results suggest that the decrease in net debt issuance activity is not likely to be driven by reduced demand for external financing.

2.5.3 Does Supplier Risk Affect Customer Capital Structure?

By construction, the data being used in this study is composed of suppliers who report their major customers. Thus, the customers are significantly larger than their suppliers who report them. Given this important characteristic of the data, if supplier risk characteristics are found to affect customer leverage, then the relationship between customer risk and supplier leverage is likely to be driven by an omitted variable, and might not be related to the business between firms. In unreported results, I failed to find a significant relationship between supplier risk

[10]Recession years are from The National Bureau of Economic Research.

characteristics and customer leverage, which suggests that risk characteristics are not likely to be correlated with omitted variables that might simultaneously affect risk and leverage.

2.5.4 Additional Controls

The first two columns of Table 2.15 report the first differences estimation results after controlling for changes in various customer characteristics, mainly changes in customer sales, customer return on assets and median leverage in the customer industry. Results are robust to these customer controls, which suggests that customer risk variables do not affect supplier leverage through their correlation with other customer characteristics.

Since, on average customer firms in the sample are very large compared to both average Compustat firm and average supplier, it is possible that changes in their risk measures proxy for the downturns in their industries. In order to test this, the third and fourth columns of Table 2.15 estimate the first differences specification including customer industry-year fixed effects. Although, the statistical significance of the coefficient estimates decreases, the coefficients are still negative after controlling for shocks to customer industry.

The last two columns of Table 2.15 present the results using percentage change in total debt (change in total debt divided by lagged total debt) rather than change in leverage ratio as the dependent variable. Results are similar to those obtained using change in leverage ratio.

2.6 Further Analyses

This section presents the results from two additional analyses. The first one studies the changes in customer risk characteristics around supplier IPOs. The second one investigates whether customer financial distress affects supplier performance.

2.6.1 Changes in Customer Profile Around Supplier IPOs

The cross-sectional results in Table 2.2 show that on average, high customer risk is associated with low supplier leverage. This suggests that the supplier's capital structure might determine how risky the major customer is. A major customer's distress can significantly restrict the supplier's financial flexibility by generating liquidity shortages, but major capital structure changes that expand the supplier's access to capital can alleviate this negative impact of customer distress.

In order to test whether customer risk profile changes with the relaxation of financial constraints, I focus on a nine-year window around supplier IPOs, specifically four years before and four years after. I exclude the IPO year and require that new customers that are reported during the four-year period following the IPO are not reported before the IPO. Also, if there is more than one year that the same customer appears before or after the IPO, I only include the first year. All customer variables are measured at the end of the year prior to the relationship. Note that the IPO year is excluded from the sample. There is no restriction on the duration of the relationships but the sales to the customer is required to be above 10% threshold.

Figure 2.2 shows the histogram of customer financial risk characteristics before and after supplier IPOs. The right tail of the distribution of customer characteristics

become thicker after supplier IPOs, especially for the distribution of credit ratings.

Table 2.16 compares average customer characteristics before and after the supplier IPO. Average customer book leverage increases by 3.2% after the IPO. Average customer credit rating increases by 1.2 notch and stock return volatility increases by about 1.7%. The customers added after the IPO are less likely to have investment grade ratings. Note that there is no change in median industry leverage of customer firms before and after the IPO, which suggests that results are not likely to be driven by changes in industries that the customer has business with or the waves in industry debt levels.

In this exercise, one concern is the changes in market conditions around the supplier IPO. If the timing of the supplier IPO coincides with a period of high demand in the customer industry, then the results in Table 2.16 could be explained by reversals in the customer industry's operating performance. In order to control for this possibility, I use regression analysis where I control for past performance of the customer industry. Table 2.17 shows the results from this regression. All coefficient estimates for the *After IPO* dummy variable have the positive sign, and they are statistically significant. This suggests that the results are not likely to be driven by reversals in the industry performance of the customer firms.

2.6.2 Supplier Operating Performance Around Customer Financial Distress

Opler and Titman (1994) argue that highly leveraged firms are likely to experience financial distress during industry downturns, and show that they perform poorly compared to their industry peers during such times. For customer distress

risk to be a concern for suppliers, the operating performance of suppliers should deteriorate when their customers are in financial distress. In order to test the impact of high-leverage customers on supplier performance, I use a specification similar to one in Opler and Titman (1994) given in Eq. (2.3).

$$\begin{aligned} Firm\ performance = \alpha\ +\ \beta_1\ Log\ of\ sales\ +\ \beta_2\ Industry-adjusted\ profitability \\ +\ \beta_3\ Industry-adjusted\ investment/assets \\ +\ \beta_5\ Industry-adjusted\ asset\ sale\ rate\ +\ \beta_6\ Customer\ leverage \\ +\ \beta_7\ Distressed\ customer\ industry\ dummy \\ +\ \beta_8\ Distressed\ customer\ industry\ dummy\ X\ Customer\ leverage \end{aligned} \tag{2.3}$$

Customer financial leverage ratio is measured two years prior to the base year (year -2). Sales growth, operating income growth and stock returns are measured over a two-year period centered around the base year (year -1 to year +1). Following Opler and Titman (1994), I assume that the customer industry is in economic distress if the median sales growth is negative and median stock return is less than -30%. All performance measures are adjusted for the supplier industry average.

Table 2.18 reports the results for suppliers with customers whose purchases constitute above and below median separately. In order to avoid any impact of customer downturn on sales, the suppliers are divided into groups conditional on their sales concentration two years prior to the base year. Customer leverage does not have any significant impact on supplier performance for the low sales group. However, customer financial distress has a negative impact on suppliers that are dependent on these customers. Dependent suppliers with high leverage customers perform poorly compared to those with low-leverage customers during customer industry downturns.

Note that earnings growth regressions do not yield significant coefficient estimates for the interaction of distressed customer industry and high customer leverage. Opler and Titman (1994) also find insignificant results for operating income regressions. They argue that large cross-sectional variation in changes in operating income or the tendency of firms facing financial difficulties to take actions that temporarily boost operating income might cause this inconclusive result. Overall, results show that customer financial distress negatively affects supplier performance, and therefore it is natural to expect suppliers to consider the risk of customers experiencing financial difficulties when they are forming business relations.

2.7 Conclusion

This essay examines the impact of customer risk on the capital structure decisions of supplier firms. Consistent with the model presented in the first chapter, the results from cross-sectional and time-series tests show that customer risk has a negative impact on suppliers' debt financing reflected in both leverage ratios and net debt issuance activity. These results are not driven by firms rebalancing their leverage ratios or decreasing their demand for external financing. The impact of customer risk is also reflected in suppliers' financing choice: During the first two years of the relationship, suppliers who raise external financing are more likely to prefer equity over debt.

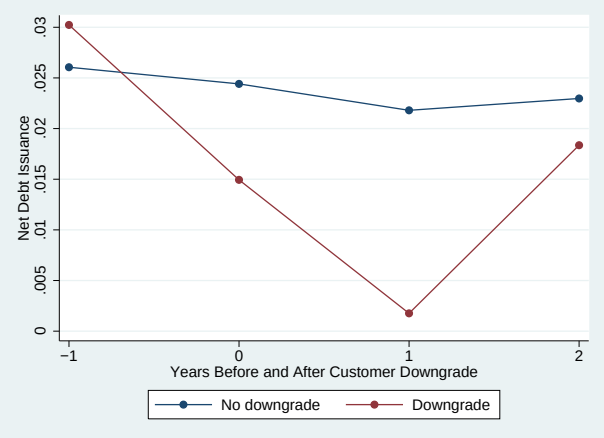
Comparing the impact of customer risk on different supplier groups shows that firms that are young and that operate in concentrated industries are more sensitive to changes in customer risk. If customer risk affects supplier's capital structure

through risk, then suppliers risk measures should capture the changes in customer risk. Consistent with this, I find that the risk is transferred from customers to suppliers: There is a lead-lag relationship between customer and supplier credit rating changes. Also, suppliers experience an increase in volatility of their stock returns after they start a new relationship with a risky customer. These results from further analyses are suggestive of customer risk affecting capital structure through its impact on supplier risk.

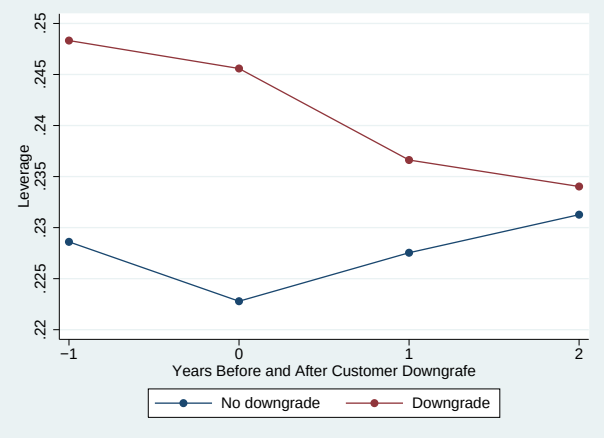
In further analyses, I investigate the changes in customer characteristics around supplier IPOs. I find that new customers added over the four years following the supplier IPO have higher leverage, lower credit ratings and higher stock return volatility compared to customers that exist prior to the IPO. Finally, I show that during customer industry downturns, dependent suppliers with high leverage customers perform poorly compared to those with low-leverage customers, which suggests that supplier performance can be seriously affected by customer distress. Overall, the results are consistent with the idea that customer risk is an important determinant of firms' financing decisions.

Figure 2.1: Supplier Leverage and Net Debt Issuance Around Customer Downgrades

Panels A, and B show the effect of customer credit rating downgrade on suppliers' net debt issuance and leverage ratio, respectively. The sample includes all customers whose credit ratings are downgraded from time -1 to time 0. For comparison, the averages for the suppliers whose customers' credit ratings are not downgraded are also plotted.



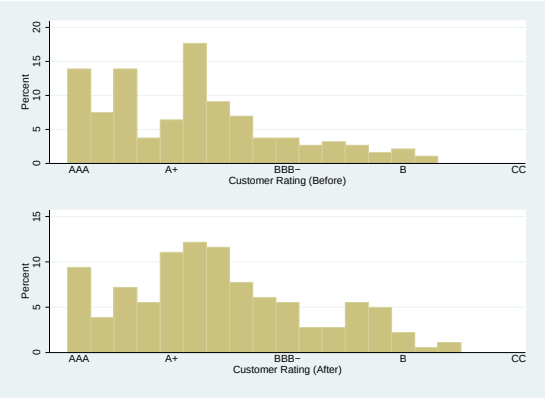
(A) The Effect of Customer Rating Downgrade on Average Net Debt Issuance



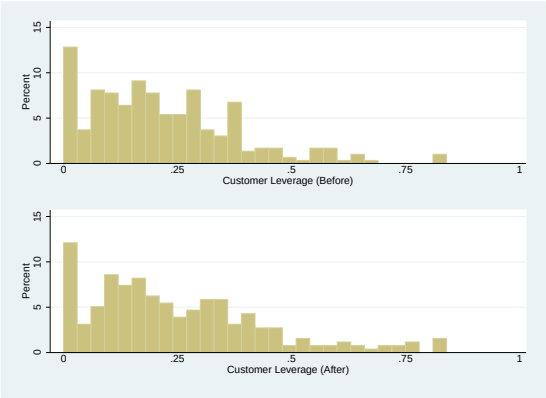
(B) The Effect of Customer Rating Downgrade on Average Leverage

Figure 2.2: Customer Characteristics Before and After Supplier IPOs

Panels A, B and C compare the empirical distribution of customer risk characteristics four years before and four years after supplier IPOs. The sample consists of suppliers who report at least one new customer over the four years following their IPO with purchases greater than 10%. For comparison, suppliers are required to have at least one customer over the four years before their IPO. If there is more than one year that the same customer appears before or after the IPO, I include only the first year. All customer variables are measured at the end of the year prior to the relationship.



(A)



(B)

(C)

Table 2.1: Summary Statistics

The sample is selected from all manufacturing suppliers with at least one major Compustat customer over the period 1976-2011. The final sample is restricted to customers whose average past purchases constitute at least 10% of the supplier's total sales, and the customer is reported by the supplier for at least three consecutive years.

PANEL A — Summary Statistics for Supplier Firms

	Mean	St. Dev.	p25	Median	p75	N
Leverage	0.229	0.208	0.039	0.196	0.352	14878
Ln(Sales)	4.810	2.017	3.433	4.725	6.137	14878
Market-to-Book	1.866	1.373	1.025	1.366	2.103	14878
ROA	0.071	0.187	0.033	0.118	0.175	14878
Tangibility	0.240	0.159	0.109	0.211	0.348	14878
R&D/Assets	0.068	0.100	0.000	0.026	0.096	14878
Credit Rating	11.092	3.519	9	12	14	2426

PANEL B — Summary Statistics for Customer Firms

	Mean	St. Dev.	p25	Median	p75	N
Leverage	0.246	0.157	0.121	0.232	0.335	14878
Ln(Sales)	9.770	1.886	8.775	10.066	11.099	14866
Market-to-Book	1.468	1.209	0.663	1.030	1.781	14353
ROA	0.142	0.076	0.092	0.143	0.183	14772
Tangibility	0.302	0.181	0.153	0.278	0.423	14878
Credit Rating	6.336	3.436	3	6	9	10533
SD(Stock Return)	0.080	0.046	0.052	0.068	0.094	13255

PANEL C — Relationship Characteristics

	Mean	St. Dev.	p25	Median	p75	N
Sales Concentration	0.240	0.159	0.137	0.180	0.283	14878
Duration	6.209	4.011	4	5	7	2827

Table 2.2: Leverage Regressions (Pooled OLS)

The sample is selected from all manufacturing suppliers with at least one major Compustat customer over the period 1976-2011. The final sample is restricted to customers whose average past purchases constitute at least 10% of the supplier's total sales, and the customer is reported by the supplier for at least three consecutive years. Heteroskedasticity-robust t-statistics are reported in parentheses. The first three columns report results with standard errors clustered at the pair level and the last three at the customer and supplier level. Statistical significance at the 10%, 5% and 1% levels are denoted by "*", "**" and "***", respectively.

	Credit Rating	Return Volatility	Ind. Adj. Book Lev	Credit Rating	Return Volatility	Ind. Adj. Book Lev
Customer Risk Proxy$_{t-1}$	-0.003**	-0.142**	-0.009	-0.003*	-0.142*	-0.009
	(-2.243)	(-2.446)	(-0.431)	(-1.773)	(-1.958)	(-0.323)
Ln(Sale$_{t-1}$)	0.025***	0.019***	0.020***	0.025***	0.019***	0.020***
	(10.732)	(9.543)	(10.309)	(7.627)	(5.955)	(6.215)
Market-to-Book$_{t-1}$	-0.007***	-0.004*	-0.008***	-0.007**	-0.004	-0.008***
	(-2.611)	(-1.778)	(-3.713)	(-2.036)	(-1.414)	(-2.829)
ROA$_{t-1}$	-0.338***	-0.341***	-0.331***	-0.338***	-0.341***	-0.331***
	(-13.202)	(-14.517)	(-15.122)	(-10.668)	(-12.100)	(-12.262)
Tangibility$_{t-1}$	0.241***	0.241***	0.243***	0.241***	0.241***	0.243***
	(8.816)	(9.942)	(10.448)	(5.755)	(6.472)	(6.621)
R&D-to-Asset$_{t-1}$	-0.352***	-0.325***	-0.323***	-0.352***	-0.325***	-0.323***
	(-6.995)	(-6.611)	(-7.453)	(-3.968)	(-3.952)	(-4.284)
Observations	10,548	13,683	14,871	10,548	13,683	14,871
R-squared	0.173	0.147	0.156	0.173	0.147	0.156
Year FE	YES	YES	YES	YES	YES	YES

Table 2.3: Leverage Regressions (Fixed Effects)

The sample is selected from all manufacturing suppliers with at least one major Compustat customer over the period 1976-2011. The final sample is restricted to customers whose average past purchases constitute at least 10% of the supplier's total sales, and the customer is reported by the supplier for at least three consecutive years. Heteroskedasticity-robust t-statistics are reported in parentheses. The first three columns report results with standard errors clustered at the pair level and the last three at the customer and supplier level. Statistical significance at the 10%, 5% and 1% levels are denoted by "*", "**" and "***", respectively.

	Credit Rating	Return Volatility	Ind. Adj. Book Lev	Credit Rating	Return Volatility	Ind. Adj. Book Lev
Customer Risk Proxy$_{t-1}$	-0.003**	-0.033	-0.023	-0.003**	-0.033	-0.023
	(-2.113)	(-0.907)	(-1.216)	(-2.411)	(-0.819)	(-1.362)
Ln(Sale$_{t-1}$)	0.029***	0.031***	0.030***	0.029***	0.031***	0.030***
	(4.561)	(5.416)	(5.785)	(4.069)	(5.130)	(5.397)
Market-to-Book$_{t-1}$	-0.010***	-0.007***	-0.008***	-0.010***	-0.007***	-0.008***
	(-4.138)	(-3.254)	(-4.132)	(-3.843)	(-2.923)	(-3.673)
ROA$_{t-1}$	-0.185***	-0.197***	-0.202***	-0.185***	-0.197***	-0.202***
	(-7.542)	(-9.078)	(-9.995)	(-6.275)	(-7.402)	(-8.024)
Tangibility$_{t-1}$	0.165***	0.161***	0.169***	0.165***	0.161***	0.169***
	(4.231)	(5.076)	(5.595)	(3.542)	(4.588)	(5.055)
R&D-to-Asset$_{t-1}$	-0.121***	-0.111**	-0.120***	-0.121**	-0.111**	-0.120***
	(-2.637)	(-2.454)	(-3.100)	(-2.474)	(-2.198)	(-2.717)
Observations	10,548	13,683	14,871	10,360	13,489	14,636
R-squared	0.072	0.071	0.078	0.072	0.071	0.078
Pair FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES

Table 2.4: Leverage Regressions (First Differences)

The sample is selected from all manufacturing suppliers with at least one major Compustat customer over the period 1976-2011. The final sample is restricted to customers whose average past purchases constitute at least 10% of the supplier's total sales, and the customer is reported by the supplier for at least three consecutive years. Heteroskedasticity-robust t-statistics are reported in parentheses. The first four columns report results with standard errors clustered at the pair level and the last four at the customer and supplier level. Statistical significance at the 10%, 5% and 1% levels are denoted by "*", "**" and "***", respectively.

	Credit Rating	Return Volatility	Ind. Adj. Book Lev	Rating Downgrade	Credit Rating	Return Volatility	Ind. Adj. Book Lev	Rating Downgrade
Δ Customer Risk Proxy$_{t-1}$	-0.005***	0.006	-0.032**		-0.005***	0.006	-0.032**	
	(-4.348)	(0.250)	(-2.371)		(-4.356)	(0.250)	(-2.375)	
1 Notch Downgrade				-0.010***				-0.010***
				(-2.681)				(-2.686)
More than 1 Notch Downgrade				-0.013***				-0.013***
				(-3.056)				(-3.062)
Δ Ln(Sale$_{t-1}$)	0.011**	0.013***	0.012***	0.012**	0.011**	0.013***	0.012***	0.012**
	(2.033)	(2.737)	(2.655)	(2.057)	(2.037)	(2.742)	(2.660)	(2.061)
Δ Market-to-Book$_{t-1}$	-0.006***	-0.004***	-0.004***	-0.006***	-0.006***	-0.004***	-0.004***	-0.006***
	(-4.157)	(-2.607)	(-3.555)	(-4.104)	(-4.165)	(-2.611)	(-3.561)	(-4.112)
Δ ROA$_{t-1}$	-0.040**	-0.033**	-0.027**	-0.040**	-0.040**	-0.033**	-0.027**	-0.040**
	(-2.320)	(-2.266)	(-2.051)	(-2.323)	(-2.324)	(-2.270)	(-2.054)	(-2.327)
Δ Tangibility$_{t-1}$	0.085***	0.104***	0.100***	0.085***	0.085***	0.104***	0.100***	0.085***
	(3.292)	(4.249)	(4.371)	(3.291)	(3.298)	(4.257)	(4.378)	(3.297)
Δ R&D-to-Asset$_{t-1}$	-0.022	-0.020	-0.020	-0.022	-0.022	-0.020	-0.020	-0.022
	(-0.603)	(-0.599)	(-0.672)	(-0.628)	(-0.604)	(-0.600)	(-0.673)	(-0.629)
Observations	9,453	12,445	13,530	9,453	9,453	12,445	13,530	9,453
R-squared	0.026	0.022	0.023	0.026	0.026	0.022	0.023	0.026
Year FE	YES	YES	YES	YES	YES	YES	YES	YES

Table 2.5: Net Debt Issuance Regressions

The sample is selected from all manufacturing suppliers with at least one major Compustat customer over the period 1976-2011. The final sample is restricted to customers whose average past purchases constitute at least 10% of the supplier's total sales, and the customer is reported by the supplier for at least three consecutive years. Heteroskedasticity-robust t-statistics are reported in parentheses. The first three columns report results with standard errors clustered at the pair level and the last three at the customer and supplier level. Statistical significance at the 10%, 5% and 1% levels are denoted by "*", "**" and "***", respectively.

	Credit Rating	Return Volatility	Ind. Adj. Book Lev	Credit Rating	Return Volatility	Ind. Adj. Book Lev
Δ Customer Risk Proxy$_{t-1}$	-0.007***	-0.043*	-0.027*	-0.007***	-0.043*	-0.027
	(-5.196)	(-1.771)	(-1.825)	(-5.571)	(-1.798)	(-1.620)
Δ Ln(Sale$_{t-1}$)	0.036***	0.042***	0.039***	0.036***	0.042***	0.039***
	(6.636)	(8.365)	(8.783)	(4.984)	(6.471)	(6.639)
Δ Market-to-Book$_{t-1}$	-0.003**	-0.000	-0.001	-0.003	-0.000	-0.001
	(-1.990)	(-0.228)	(-0.424)	(-1.444)	(-0.162)	(-0.312)
Δ ROA$_{t-1}$	0.002	0.001	0.004	0.002	0.001	0.004
	(0.149)	(0.099)	(0.354)	(0.137)	(0.089)	(0.321)
Δ Tangibility$_{t-1}$	0.111***	0.126***	0.121***	0.111***	0.126***	0.121***
	(3.479)	(4.595)	(4.738)	(2.870)	(3.767)	(3.852)
Δ R&D-to-Asset$_{t-1}$	0.057*	0.047	0.052*	0.057	0.047	0.052
	(1.698)	(1.501)	(1.853)	(1.492)	(1.361)	(1.629)
Observations	9,453	12,445	13,530	9,453	12,445	13,530
R-squared	0.038	0.037	0.038	0.038	0.037	0.038
Year FE	YES	YES	YES	YES	YES	YES

Table 2.6: Beginning-of-the Relationship Debt-Equity Choice

The sample is selected from all manufacturing suppliers with at least one major Compustat customer over the period 1976-2011. The final sample is restricted to customers whose average past purchases constitute at least 10% of the supplier's total sales, and the customer is reported by the supplier for at least three consecutive years. *Net Debt (Equity) Issuance Dummy* takes one when the net amount of debt (equity) issued exceeds 5% of total assets and zero otherwise. *Debt vs. Equity Dummy* takes one when the net amount of debt issued exceeds 5% of total assets and zero when the net amount of equity issued exceeds 5% of total assets. Heteroskedasticity-robust t-statistics are reported in parentheses. Standard errors clustered at the pair level. Statistical significance at the 10%, 5% and 1% levels are denoted by "*", "**" and "***", respectively.

	Net Debt Issuance Dummy			Net Equity Issuance Dummy			Debt vs. Equity Dummy		
	Credit Rating	Return Volatility	Ind. Adj. Book Lev	Credit Rating	Return Volatility	Ind. Adj. Book Lev	Credit Rating	Return Volatility	Ind. Adj. Book Lev
Customer Risk Proxy$_{t-1}$	-0.002	-0.412***	-0.053	0.006**	0.509***	-0.001	-0.010**	-0.812**	-0.124
	(-0.906)	(-3.461)	(-1.068)	(2.036)	(3.195)	(-0.020)	(-2.067)	(-2.559)	(-1.312)
$\Delta Ln(Sale_{t-1})$	0.072***	0.083***	0.077***	0.171***	0.157***	0.151***	-0.129***	-0.090***	-0.101***
	(3.373)	(4.273)	(4.220)	(5.808)	(6.055)	(6.402)	(-3.478)	(-2.962)	(-3.512)
$\Delta Market-to-Book_{t-1}$	-0.007	-0.000	-0.002	0.033***	0.035***	0.044***	-0.036***	-0.032***	-0.037***
	(-0.934)	(-0.012)	(-0.319)	(3.331)	(3.701)	(5.137)	(-3.108)	(-3.095)	(-3.910)
ΔROA_{t-1}	-0.083	-0.113*	-0.062	-0.090	-0.044	-0.034	0.042	-0.054	-0.024
	(-1.221)	(-1.880)	(-1.099)	(-0.975)	(-0.541)	(-0.435)	(0.385)	(-0.551)	(-0.269)
$\Delta Tangibility_{t-1}$	0.266*	0.386***	0.418***	0.301*	0.237	0.297**	0.103	0.284	0.245
	(1.689)	(2.855)	(3.218)	(1.648)	(1.624)	(2.114)	(0.409)	(1.308)	(1.159)
$\Delta R\&D-to-Asset_{t-1}$	0.040	-0.022	0.068	0.398*	0.398**	0.322*	-0.152	-0.230	-0.091
	(0.253)	(-0.146)	(0.497)	(1.903)	(2.036)	(1.765)	(-0.624)	(-1.009)	(-0.443)
Observations	2,366	2,949	3,309	2,200	2,766	3,103	749	960	1,081
R-squared	0.050	0.049	0.046	0.063	0.065	0.067	0.161	0.153	0.144
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 2.7: Customer Risk-Supplier Leverage Relation and Supplier Characteristics

The sample is selected from all manufacturing suppliers with at least one major Compustat customer over the period 1976-2011. The final sample is restricted to customers whose average past purchases constitute at least 10% of the supplier's total sales, and the customer is reported by the supplier for at least three consecutive years. The coefficient estimate of Δ *Customer Rating* is for the base group which consists of either the youngest suppliers, suppliers in the least concentrated industries or those with customers operating in the least concentrated industries. The main effects of age, supplier and customer industry concentration are not reported. Heteroskedasticity-robust t-statistics are reported in parentheses. Standard errors are clustered at the pair level. Statistical significance at the 10%, 5% and 1% levels are denoted by "*", "**" and "***", respectively.

	Supplier Age	Supplier Ind. Concentration	Customer Ind. Concentration
Δ Customer Rating$_{t-1}$	-0.010***	-0.002	-0.001
	(-3.312)	(-0.868)	(-0.542)
X Medium	0.004	-0.003	-0.006**
	(0.999)	(-0.878)	(-2.113)
X High	0.007**	-0.007***	-0.005*
	(2.068)	(-2.626)	(-1.877)
Δ Ln(Sale$_{t-1}$)	0.011*	0.012**	0.011**
	(1.896)	(2.079)	(2.034)
Δ Market-to-Book$_{t-1}$	-0.006***	-0.006***	-0.006***
	(-4.143)	(-4.115)	(-4.096)
Δ ROA$_{t-1}$	-0.039**	-0.040**	-0.040**
	(-2.275)	(-2.344)	(-2.331)
Δ Tangibility$_{t-1}$	0.085***	0.085***	0.085***
	(3.267)	(3.281)	(3.278)
Δ R&D-to-Asset$_{t-1}$	-0.022	-0.022	-0.022
	(-0.610)	(-0.629)	(-0.626)
Observations	9,453	9,453	9,452
R-squared	0.027	0.027	0.027
Year FE	YES	YES	YES

Table 2.8: Customer and Supplier Credit Ratings (Annual)

The table reports the regression results for change in supplier credit ratings. The sample is selected from all manufacturing suppliers with at least one major Compustat customer over the period 1976-2011. The final sample is restricted to customers whose average past purchases constitute at least 10% of the supplier's total sales, and the customer is reported by the supplier for at least three consecutive years. Standard errors are clustered at the pair level. Heteroskedasticity-robust t-statistics are reported in parentheses. Statistical significance at the 10%, 5% and 1% levels are denoted by "*", "**" and "***", respectively.

	Δ Supplier Rating$_t$				Δ Customer Rating$_t$	
Δ Customer Rating$_t$	0.047					
	(1.608)					
Δ Customer Rating$_{t-1}$		0.092***	0.100***			
		(3.671)	(3.691)			
1 Notch Dummy$_{t-1}$				0.113		
				(1.432)		
More than 1 Notch Dummy$_{t-1}$				0.273***		
				(3.710)		
Δ Supplier Rating$_{t-1}$					-0.012	
					(-0.574)	
Δ Supplier Rating$_t$						0.035
						(1.445)
Δ Customer Ind. Sales Growth$_{t-1}$			-0.094			
			(-0.664)			
Δ Customer Ind. Market-to-Book$_{t-1}$			-0.144			
			(-1.000)			
Δ Customer Ind. ROA$_{t-1}$			-1.386			
			(-0.693)			
Δ Supplier Ind. Sales Growth$_{t-1}$			0.430***			
			(4.113)			
Δ Supplier Ind. Market-to-Book$_{t-1}$			0.032			
			(0.429)			
Δ Supplier Ind. ROA$_{t-1}$			-1.237			
			(-1.109)			
Observations	2,280	2,235	2,201	2,235	2,118	2,280
R-squared	0.048	0.053	0.063	0.051	0.075	0.073
Year FE	YES	YES	YES	YES	YES	YES

Table 2.9: Customer and Supplier Credit Ratings (Monthly)

The table reports the regression results for change in supplier credit ratings. The sample is selected from all manufacturing suppliers with at least one major Compustat customer over the period 1976-2011. The final sample is restricted to customers whose average past purchases constitute at least 10% of the supplier's total sales, and the customer is reported by the supplier for at least three consecutive years. Standard errors are clustered at the pair level. Heteroskedasticity-robust t-statistics are reported in parentheses. Statistical significance at the 10%, 5% and 1% levels are denoted by "*", "**" and "***", respectively.

	Δ Supplier Rating$_t$				Δ Customer Rating$_t$	
Δ Customer Rating$_t$	0.017		0.017			
	(1.214)		(1.228)			
Δ Customer Rating$_{t-1}$		0.022**	0.023**			
		(2.147)	(2.216)			
1 Notch Dummy				0.038*		
				(1.677)		
More than 1 Notch Dummy				0.077**		
				(2.451)		
Δ Supplier Rating$_t$					0.010	
					(1.185)	
Δ Supplier Rating$_{t-1}$						0.003
						(0.757)
Observations	32,560	32,513	32,491	32,513	32,560	32,317
R-squared	0.022	0.022	0.023	0.023	0.077	0.078
Month FE	YES	YES	YES	YES	YES	YES

Table 2.10: Customer and Supplier Stock Return Volatility (Monthly)

The table reports the regression results for change in supplier stock return volatility within the first two years of the relationship compared to the year before the relationship starts. The sample is selected from all manufacturing suppliers with at least one major Compustat customer over the period 1976-2011. The final sample is restricted to customers whose average past purchases constitute at least 10% of the supplier's total sales, and the customer is reported by the supplier for at least three consecutive years. Standard errors are clustered at the pair level. Heteroskedasticity-robust t-statistics are reported in parentheses. Statistical significance at the 10%, 5% and 1% levels are denoted by "*", "**" and "***", respectively.

	All Suppliers	Small Suppliers	Large Suppliers	Low Customer Ind. Concen.	High Customer Ind. Concen.
After Dummy	0.002***	0.005***	0.001	0.003*	0.002*
	(2.715)	(3.157)	(1.219)	(1.693)	(1.896)
Ex-ante Customer Vol.	-0.077**	-0.112**	-0.108**	-0.017	-0.114*
	(-2.029)	(-2.225)	(-2.335)	(-0.326)	(-1.892)
After Dummy	0.168***	0.190***	0.138***	0.153**	0.184***
X Ex-ante Customer Vol.	(3.974)	(3.118)	(2.866)	(2.198)	(3.162)
Ex-ante Supplier Vol.	0.770***	0.620***	0.774***	0.771***	0.770***
	(31.196)	(16.459)	(27.009)	(25.664)	(18.417)
After Dummy	-0.148***	-0.203***	-0.125***	-0.134***	-0.163***
X Ex-ante Supplier Vol.	(-6.213)	(-5.899)	(-3.885)	(-3.596)	(-5.283)
Observations	55,267	26,550	28,717	26,947	25,872
R-squared	0.385	0.331	0.427	0.396	0.392
Month FE	YES	YES	YES	YES	YES

Table 2.11: The Impact of Customer Rating Changes on Survival

The table reports the results from the Cox proportional hazard model of relationship survival. The sample is selected from all manufacturing suppliers with at least one major Compustat customer over the period 1976-2011. The final sample is restricted to customers whose average past purchases constitute at least 10% of the supplier's total sales, and the customer is reported by the supplier for at least three consecutive years. Standard errors are clustered at the pair level. Heteroskedasticity-robust t-statistics are reported in parentheses. Statistical significance at the 10%, 5% and 1% levels are denoted by "*", "**" and "***", respectively.

	Coefficients			
Customer Rating Downgrade$_{t-1}$	0.188**		0.387***	0.506***
	(2.171)		(3.139)	(3.778)
1 Notch Dummy$_{t-1}$		0.216**		
		(2.012)		
More than 1 Notch Dummy$_{t-1}$		0.152		
		(1.247)		
X Medium R&D Supplier Dummy			-0.221	
			(-1.255)	
X High R&D Supplier Dummy			-0.361**	
			(-2.051)	
X Medium Supplier Dummy				-0.412**
				(-2.246)
X Large Supplier Dummy				-0.521***
				(-2.775)
Supplier Size$_{t-1}$	-0.213***	-0.214***	-0.213***	-0.200***
	(-14.552)	(-14.552)	(-14.550)	(-12.761)
Supplier ROA$_{t-1}$	0.323***	0.322***	0.291**	0.317**
	(2.591)	(2.584)	(2.294)	(2.546)
Customer Size$_{t-1}$	-0.025	-0.025	-0.024	-0.023
	(-1.327)	(-1.314)	(-1.274)	(-1.209)
Customer ROA$_{t-1}$	0.299	0.288	0.240	0.302
	(0.724)	(0.696)	(0.580)	(0.731)
Observations	9,959	9,959	9,959	9,959

Table 2.12: Net Debt Issuance Activity by Leverage

The table reports the regression results of net debt issuance activity on customer credit rating downgrade dummy for different supplier leverage quartiles. The sample is selected from all manufacturing suppliers with at least one major Compustat customer over the period 1976-2011. The final sample is restricted to customers whose average past purchases constitute at least 10% of the supplier's total sales, and the customer is reported by the supplier for at least three consecutive years. The p-values under the Wald test are reported for the difference of coefficient estimates for each quartile from the coefficient of quartile 1. Statistical significance at the 10%, 5% and 1% levels are denoted by "*", "**" and "***", respectively.

	(Low Leverage)			(High Leverage)
	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Customer Rating	-0.013***	-0.011*	-0.015**	-0.024***
Downgrade	(-2.738)	(-1.707)	(-2.190)	(-3.520)
P-value		0.7727	0.8153	0.1797
Observations	2,815	2,655	2,795	2,966
R-squared	0.002	0.001	0.002	0.004

Table 2.13: Net Debt Issuance Regressions with Financial Deficit

The sample is selected from all manufacturing suppliers with at least one major Compustat customer over the period 1976-2011. The final sample is restricted to customers whose average past purchases constitute at least 10% of the supplier's total sales, and the customer is reported by the supplier for at least three consecutive years. Heteroskedasticity-robust t-statistics are reported in parentheses. Standard errors are clustered at the pair level. The first four columns report results with standard errors clustered at the pair level and the last four at the customer and supplier level. Statistical significance at the 10%, 5% and 1% levels are denoted by "*", "**" and "***", respectively.

	Credit Rating	Return Volatility	Ind. Adj. Book Lev	Credit Rating	Return Volatility	Ind. Adj. Book Lev
Δ Customer Risk Proxy$_{t-1}$	-0.007***	-0.040*	-0.024*	-0.006***	-0.042*	-0.025*
	(-5.115)	(-1.659)	(-1.650)	(-4.652)	(-1.754)	(-1.723)
Financing Deficit$_t$	0.061***	0.073***	0.061***			
	(7.584)	(9.416)	(8.555)			
CAPX$_t$/PPENT$_{t-1}$				0.060***	0.071***	0.069***
				(11.030)	(13.962)	(14.721)
Δ Ln(Sale$_{t-1}$)	0.031***	0.036***	0.034***	0.025***	0.028***	0.025***
	(5.998)	(7.407)	(7.789)	(4.686)	(5.594)	(5.767)
Δ Market-to-Book$_{t-1}$	-0.005***	-0.003**	-0.003**	-0.004***	-0.001	-0.002
	(-3.591)	(-2.194)	(-2.508)	(-2.650)	(-0.926)	(-1.316)
Δ ROA$_{t-1}$	0.008	0.007	0.009	0.000	-0.001	0.001
	(0.590)	(0.584)	(0.826)	(0.010)	(-0.110)	(0.116)
Δ Tangibility$_{t-1}$	0.094***	0.107***	0.104***	0.119***	0.130***	0.128***
	(3.046)	(3.992)	(4.145)	(3.851)	(4.907)	(5.149)
Δ R&D-to-Asset$_{t-1}$	0.036	0.019	0.035	0.075**	0.065**	0.074***
	(1.093)	(0.629)	(1.245)	(2.226)	(2.108)	(2.624)
Observations	9,453	12,445	13,530	9,421	12,398	13,470
R-squared	0.054	0.057	0.054	0.058	0.063	0.064
Year FE	YES	YES	YES	YES	YES	YES

Table 2.14: Customer Risk and Supplier Investment

The sample is selected from all manufacturing suppliers with at least one major Compustat customer over the period 1976-2011. The final sample is restricted to customers whose average past purchases constitute at least 10% of the supplier's total sales, and the customer is reported by the supplier for at least three consecutive years. Standard errors clustered at the pair level. Heteroskedasticity-robust t-statistics are reported in parentheses. Statistical significance at the 10%, 5% and 1% levels are denoted by "*", "**" and "***", respectively.

	Levels			First Differences		
	Credit Rating	Return Volatility	Ind. Adj. Book Lev	Credit Rating	Return Volatility	Ind. Adj. Book Lev
Customer Risk Proxy$_{t-1}$	0.001	0.025	0.010	-0.004	0.121	0.043
	(0.299)	(0.242)	(0.345)	(-1.105)	(1.148)	(1.121)
CF$_{t-1}$/PPE$_{t-1}$	0.018***	0.017***	0.017***	0.014***	0.014***	0.015***
	(5.432)	(5.488)	(6.020)	(4.439)	(4.746)	(5.585)
Market-to-Book$_{t-1}$	0.087***	0.092***	0.089***	0.065***	0.064***	0.065***
	(15.991)	(17.747)	(18.619)	(10.892)	(11.914)	(13.270)
Observations	10,486	13,411	14,571	9,392	12,155	13,213
R-squared	0.121	0.117	0.118	0.059	0.052	0.057
Pair FE	YES	YES	YES	NO	NO	NO
Year FE	YES	YES	YES	YES	YES	YES

Table 2.15: Additional Robustness Tests

The sample is selected from all manufacturing suppliers with at least one major Compustat customer over the period 1976-2011. The final sample is restricted to customers whose average past purchases constitute at least 10% of the supplier's total sales, and the customer is reported by the supplier for at least three consecutive years. Heteroskedasticity-robust t-statistics are reported in parentheses. Standard errors are clustered at the pair level. Statistical significance at the 10%, 5% and 1% levels are denoted by "*", "**" and "***", respectively.

			Δ Book Leverage$_t$		Δ Total Debt$_t$/ Total Debt$_{t-1}$	
Δ Customer Rating$_{t-1}$	-0.005***		-0.004***		-0.051***	
	(-4.134)		(-2.981)		(-4.768)	
Δ Customer Ind. Adj. Lev.$_{t-1}$		-0.036**		-0.035**		-0.233*
		(-2.397)		(-2.097)		(-1.947)
Δ Ln(Sale$_{t-1}$)	0.012**	0.012***	0.012*	0.010**	0.267***	0.264***
	(2.107)	-2.679	(1.960)	(2.107)	(6.381)	(7.694)
Δ Market-to-Book$_{t-1}$	-0.006***	-0.005***	-0.006***	-0.004***	-0.005	0.002
	(-4.267)	(-3.780)	(-3.694)	(-2.898)	(-0.292)	(0.182)
Δ ROA$_{t-1}$	-0.040**	-0.028**	-0.038**	-0.025*	-0.158	-0.097
	(-2.334)	(-2.062)	(-2.137)	(-1.787)	(-1.518)	(-1.156)
Δ Tangibility$_{t-1}$	0.084***	0.096***	0.087***	0.098***	0.958***	0.944***
	(3.227)	(4.198)	(3.135)	(4.150)	(3.918)	(5.217)
Δ R&D-to-Asset$_{t-1}$	-0.021	-0.021	-0.012	-0.021	0.147	0.248
	(-0.598)	(-0.702)	(-0.353)	(-0.696)	(0.447)	(0.911)
Δ Customer Ln(Sale$_{t-1}$)	0.008	0.006				
	(0.877)	(1.067)				
Δ Customer ROA$_{t-1}$	-0.012	-0.008				
	(-0.339)	(-0.270)				
Δ Customer Median Leverage$_{t-1}$	0.057	0.014				
	(1.089)	(0.312)				
Observations	9,346	13,407	9,451	13,530	8,237	11,833
R-squared	0.026	0.023	0.118	0.109	0.028	0.028
Year FE	YES	YES			YES	YES
Customer Ind-Year FE			YES	YES		

Table 2.16: Customer Financial Risk Before and After Supplier IPO (Univariate)

The sample consists of suppliers who report at least one new customer over the four years following their IPO. For comparison, suppliers are required to have at least one customer over the four years before their IPO. There is no restriction on the customers reported before the IPO, but the customers after the IPO are required to be reported for the first time. Customers that exist or newly added in the IPO year are excluded. If there is more than one year that the same customer appears before or after the IPO, I include only the first year. All customer variables are measured at the end of the year prior to the relationship. *After IPO* takes one if the customer is added within the four years following the supplier IPO and zero if the customer is reported before the IPO. t-statistics are reported in parentheses. Statistical significance at the 10%, 5% and 1% levels are denoted by "*", "**" and "***", respectively.

	(Book) Leverage	Ind-Adj. (Book) Lev.	Credit Rating	Median Ind. Lev.	St. Dev. Of Monthly Returns	Investment Grade
After IPO	0.032**	0.022	1.195***	0.010	0.017***	-0.065*
	(2.099)	(1.613)	(2.938)	(1.072)	(2.894)	(-1.684)
Observations	552	552	368	558	437	368
R-squared	0.008	0.005	0.023	0.002	0.019	0.008

Table 2.17: Customer Financial Risk Before and After Supplier IPO (Multivariate)

The sample consists of suppliers who report at least one new customer over the four years following their IPO. For comparison, suppliers are required to have at least one customer over the four years before their IPO. There is no restriction on the customers reported before the IPO, but the customers after the IPO are required to be reported for the first time. Customers that exist or newly added in the IPO year are excluded. If there is more than one year that the same customer appears before or after the IPO, I include only the first year. All customer variables are measured at the end of the year prior to the relationship. *After IPO* takes one if the customer is added within the four years following the supplier IPO and zero if the customer is reported before the IPO. Standard errors are clustered at the supplier level. Heteroskedasticity-robust t-statistics are reported in parentheses. Statistical significance at the 10%, 5% and 1% levels are denoted by "*", "**" and "***", respectively.

	Credit Rating	St. Dev. Of Stock Returns	Book Leverage	Credit Rating	St. Dev. Of Stock Returns	Book Leverage
After Supplier IPO Dummy	0.847**	0.012*	0.026*	1.046**	0.014**	0.027*
	(2.249)	(1.803)	(1.815)	(2.590)	(2.210)	(1.908)
Customer Median Ind. Sales Growth$_{t-4}$	2.160**	0.046**	-0.023			
	(2.213)	(2.292)	(-0.677)			
Customer Median Ind. Sales Growth$_{t-3}$	2.731**	-0.003	-0.106**			
	(2.052)	(-0.166)	(-2.467)			
Customer Median Ind. Sales Growth$_{t-2}$	-0.575	0.028	0.013			
	(-0.451)	(1.613)	(0.245)			
Customer Median Ind. Sales Growth$_{t-1}$	2.000**	-0.019	0.047			
	(2.240)	(-0.920)	(0.946)			
Customer Median Ind. Stock Return$_{t-4}$				-1.446	-0.044***	-0.009
				(-1.300)	(-3.140)	(-0.251)
Customer Median Ind. Stock Return$_{t-3}$				-0.640	-0.051***	0.042
				(-0.595)	(-3.078)	(1.139)
Customer Median Ind. Stock Return$_{t-2}$				-0.800	-0.030	0.059*
				(-0.686)	(-1.498)	(1.679)
Customer Median Ind. Stock Return$_{t-1}$				-1.681*	-0.061***	0.046
				(-1.665)	(-3.258)	(1.205)
Observations	348	385	464	357	405	500
R-squared	0.125	0.085	0.036	0.036	0.100	0.017

Table 2.18: Supplier Performance Around Customer Financial Distress

Industry adjustments are carried out by subtracting industry mean from the firm's performance. Ex-ante supplier and customer leverage ratios are measured two years prior to the base year. Stock returns, operating income growth and sales growth are measured over a two-year period centered around the base year. Customer firms are selected into economically distressed category if their median industry sales growth is negative and median stock return is less than 30%. Suppliers are divided into two according to the percentage sales to their major customer as *High Sales* and *Low Sales*. Heteroskedasticity-robust t-statistics are reported in parentheses. Standard errors are clustered at the pair level. Statistical significance at the 10%, 5% and 1% levels are denoted by "*", "**" and "***", respectively.

	Ind-Adj. Sales Growth		Ind-Adj. Stock Return		Ind-Adj. Earnings Growth	
	High Sales	Low Sales	High Sales	Low Sales	High Sales	Low Sales
Ln(Sales)	0.009*	0.001	0.009	0.020***	-0.006	0.011
	(1.729)	(0.147)	(1.216)	(3.225)	(-0.453)	(0.978)
Ind.-adj. profitability before base year	-0.107	-0.013	0.297***	0.256***	0.512***	0.759***
	(-1.531)	(-0.211)	(4.092)	(3.529)	(4.213)	(6.048)
Ind.-adj investment before base year	0.375**	0.611***	-0.272	-0.379	1.091***	-0.086
	(2.197)	(3.507)	(-1.249)	(-1.440)	(2.779)	(-0.171)
Ind.-adj asset sales	0.068*	0.082**	0.062	0.091*	0.247**	0.514***
	(1.707)	(2.400)	(1.153)	(1.754)	(2.384)	(5.266)
Distressed customer industry dummy	0.041	-0.068	-0.019	-0.177**	-0.519***	-0.175
	(0.525)	(-1.030)	(-0.258)	(-2.264)	(-2.669)	(-0.853)
Customer leverage	-0.016	-0.028	0.099	0.186**	0.112	0.192
	(-0.261)	(-0.513)	(1.308)	(2.165)	(0.727)	(1.291)
Distressed customer industry dummy	-0.437**	-0.139	-0.472*	0.058	-0.126	0.085
X Customer leverage	(-2.132)	(-0.858)	(-1.678)	(0.204)	(-0.207)	(0.139)
Observations	4,999	5,269	4,469	4,792	5,098	5,301
R-squared	0.021	0.022	0.031	0.026	0.014	0.023
Year FE	YES	YES	YES	YES	YES	YES

Appendix A: Supplementary Tables

Table A1: Variable Definitions

This table details the variable construction for analysis of the sample. The variable Xpressfeed pneumonics are given in italic.

Variable	Compustat Item Name
Total Debt	Short-Term Debt + Long-Term Debt = **dltt** + **dlc**
Book Leverage	Total Debt / Total Book Assets = **dltt** + **dlc** / **at**
Profitability	EBITDA / Assets = **oibdp** / **at**
Market Value of Assets	= **at** + **prccf** * **csho** - **ceq** - **txdb**
Equity	= **at-(lt+pstkl-txditc-dcvt)**
Net Debt Issuance	= [**dltt(t)** + **dlc(t)** - (**dltt(t-1)** + **dlc(t-1)**)] / **at(t-1)**
Net Equity Issuance	= [**Equity-Equity(t-1)** - **(re-re(t-1))**] / **at(t-1)**
Sales	= **Ln(sale)**
Tangibility	Net PPE / Assets = **ppent** / **at**
Market-to-Book Ratio	MVA / Total Book Assets
R&D	= **xrd** / **at**
Size	Ln(Total Book Assets)

Table A2: Industry Distribution of Supplier Firms (1976-2011)

The sample is selected from all manufacturing suppliers with at least one major Compustat customer over the period 1976-2011. The final sample is restricted to customers whose average past purchases constitute at least 10% of the supplier's total sales, and the customer is reported by the supplier for at least three consecutive years. The last two columns report the number and percentage of observations in the corresponding industries in Compustat universe. Industries are defined at the 2-digit SIC code level.

Two-digit SIC code		Supplier Firms		Compustat Firms	
		Freq.	Percent	Freq.	Percent
20	Food and kindred products	510	3.43	7,316	5.68
21	Tobacco products	0	0	359	0.28
22	Textile mill products	301	2.02	2,161	1.68
23	Apparel & other finished products	809	5.44	2,910	2.26
24	Lumber and wood products ex. furn.	68	0.46	2,122	1.65
25	Furniture and fixture	253	1.7	1,801	1.4
26	Paper and allied products	135	0.91	3,343	2.6
27	Printing publishing and allied	153	1.03	4,145	3.22
28	Chemicals and allied	2,341	15.73	21,207	16.46
29	Petroleum refining and related inds.	32	0.22	2,134	1.66
30	Rubber & misc. plastic products	455	3.06	3,703	2.87
31	Leather and leather products	110	0.74	842	0.65
32	Stone clay glass concrete products	172	1.16	2,197	1.71
33	Primary metal industries	394	2.65	4,708	3.66
34	Fabr. metal ex. machy., trans. eq.	692	4.65	5,235	4.06
35	Inds. comml. machy computer eq.	1,936	13.01	17,124	13.29
36	Electr. oth. elec. eq. ex. cmp.	3,098	20.82	21,185	16.45
37	Transportation equipment	1,622	10.9	6,421	4.99
38	Measr. instr. photo gds. watches	1,364	9.17	16,707	12.97
39	Misc. manufacturing industries	433	2.91	3,186	2.47
	Total	14,878	100	128,806	100

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